FM 21–40
*C 1

BASIC FIELD MANUAL

DEFENSE AGAINST CHEMICAL ATTACK

CHANGES No. 1

WAR DEPARTMENT,
WASHINGTON 25, D. C., 11 September 1943.

FM 21–40, 7 September 1942, is changed as follows:

The following new and changed symbols for chemical agents referred to in this manual are listed below. These symbols will be corrected wherever they occur in the manual.

Agent	*Symbol*	
	Old	*New*
Lewisite	M–1	L
Mustard gas	HS	H
Mustard-lewisite mixture	MS	HL
Brombenzylcyanide	CA	BBC
Arsine		SA
Hydrocyanic acid		AC

The following is added to the table, Vesicants, page 10.

NAME AND SYMBOL	NITROGEN MUSTARDS (HN)
Odor	Faint odors varying from fishy or soft-soaplike to practically odorless.
Color and state in field	Varying from liquids to low melting solids, colorless to pale yellow.
Effects on body	Vesicant, blisters skin. Vapors only about one-fifth as damaging to skin as equal concentrations of ordinary mustard gas; liquids blister more rapidly but less severely than equal amounts of ordinary mustard gas. Damage to eyes varies according to kind used; all will damage eyes both as vapor and liquid. Dif-

*The individual items in this change will be cut apart and pasted over the specific paragraphs or subparagraphs affected. This change supersedes section II, Training Circular No. 3, and section I, Training Circular No. 67, War Department, 1942; and Training Circular No. 51, War Department, 1942.

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NAME AND SYMBOL	NITROGEN MUSTARDS (HN)
	fering from other vesicants, the vapors produce serious eye casualties, at concentrations too low to be detected by odor or irritation. All are highly toxic by inhalation, the concentrations required for lethal effect varying from less than, to three times, that of ordinary mustard gas. However, the least toxic is also the most volatile, so it may be just as damaging in the field as the more highly toxic ones. Systemic poisoning, affects nervous system.
First-aid treatment	Remove contaminated clothing, wash skin with soap and water, or apply protective ointment and wash with water. If liquid enters eye, flush with water. All first aid must be effected as quickly as possible.
Persistency	Varies from one-fifth of mustard gas to much more than ordinary mustard gas.
Action on food and water	Renders unprotected food and water unfit for use. The senses are unreliable to detect contamination.
Action on metals	Slight.
How used	For casualty effect or to deny ground through threat of casualties. Probably disseminated by same means used for ordinary mustard gas.
Protection required	Gas mask and protective clothing. Eye-shields and individual protective covers against spray.

The following is added to the table, Screening smokes (page 14).

NAME AND SYMBOL	TITANIUM TETRACHLORIDE (FM)
Odor	Acrid.
Color and state in field	Dispersed as a liquid which changes to white smoke upon contact with air.
Effects on body	Liquid burns. Also strong acid; vapor and smoke irritating to throat.
First-aid treatment	None necessary for smokes; for liquid agent, wash affected parts with water and then with soap and water.
Action on food and water	Liquid makes food and water unpalatable but not toxic.
Action on metals	Some corrosion by the smoke; none by liquid on steel, if dry; vigorous corrosion if moist.
How used	In airplane spray for screening; in artillery shell, mortar shell, and, for training, in cylinders to simulate cloud gas.
Protection required	Gas masks, in heavy concentrations.

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

■ 7. CHEMICAL AGENTS.

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b. Vesicants.

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(2) *Lewisite (L).*—Lewisite, colorless in * * * threat of casualties. It is dispersed by the same means as mustard gas and is very effective when sprayed from an airplane. The greatest danger to personnel in a spray attack of lewisite is that of getting drops in the eyes. This will result in almost instant injury and later permanent blindness unless eye ointment M–1 (or BAL) or eye solution M–1 is applied to the eyes quickly. Headache, violent coughing and sneezing, and possibly vomiting will be the result of a few breaths of a high concentration of lewisite vapor following an airplane spray attack. Nearly odorless in * * * corrosive to metals. For cold weather spraying, mixtures of lewisite with mustard gas (HL) in varying proportions will produce solutions with lower freezing points than either of the agents singly.

(3) Nitrogen mustards (HN) (added).—Nitrogen mustards vary from liquids to low melting solids, are colorless to pale yellow, and have faint odors varying from fishy or soft-soap-like to practically odorless. Because of this lack of pronounced odor, personnel may, without being aware of the presence of a chemical agent, undergo exposure which will produce eye and respiratory casualties. As in the case of lewisite, the great danger from a spray attack is serious injury caused by getting drops in the eyes. Their volatility varies from much less to five times greater than that of ordinary mustard gas (H). Nitrogen mustards hydrolyze very slowly in water. The hydrolysis is not complete except in water containing alkali (pH above 7-8), and even then elevated temperatures must be used to get noticeable rates of hydrolysis. The products of hydrolysis are relatively harmless. The nitrogen mustards vary greatly in toxic effects. They vary greatly in power to damage the eyes. The less volatile members are much less effective than equal concentrations of ordinary mustard gas vapor, while the more volatile members produce damage to the eyes equal to or greater

than that produced by a similar mustard gas exposure. Although flushing the eyes with water is effective in the case of liquid nitrogen mustards, there is no satisfactory first-aid measure for eye injuries from the vapor. The more volatile members in liquid form damage the eyes more severely than ordinary liquid mustard gas. The less volatile members damage the respiratory tract to about the same degree as an equal concentration of mustard gas vapor, but because of their low volatility may be less dangerous in the field than mustard gas. The most volatile member is only one-third as effective on the respiratory tract as is mustard gas vapor of equal concentration, but because of its great volatility a heavy field contamination may be as dangerous to the respiratory tract as a similar mustard gas contamination. The vapors are only about one-fifth as damaging to the skin as an equal concentration of ordinary mustard gas vapor. The liquids blister the skin more rapidly, but less severely, than equal amounts of ordinary mustard gas.

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f. Screening smokes.

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(1) *Sulfur trioxide solution (FS).*—A solution of * * * 30 to 60 seconds.

(1½) (Added.) *Titanium tetrachloride (FM).*—Titanium tetrachloride is a liquid smoke agent. It is employed for the same purposes and dispersed in the same ways as FS. It is less corrosive than FS, and its vapors and smoke are irritating to the throat.

(2) *HC mixture.*—This consists of * * * grayish-white smoke. Screens are developed by various size smoke pots, for training purposes; grenades, floating smoke pots, and artillery shells for combat purposes. The obscuring value * * * sometimes more desirable. Its fumes are noninjurious to fabrics or metals.

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(4) (Added.) *Precautions.*—Screening smokes consist of finely divided solid particles or liquid droplets suspended in the atmosphere. The suspended material may consist of metallic salts, metallic oxides, inorganic acids, hydrocarbons, and other materials. Any of these substances may be injurious if heavy concentra-

tions are breathed for relatively long periods of time. Therefore if personnel must remain close down wind from smoke generators, gas masks should be worn to assure adequate protection. It is estimated that the maximum allowable exposure should be not more than 10 minutes within a distance of 10 yards of the generators if the gas mask is not worn. Since some individuals are more sensitive than others to these agents, gas masks should be worn if unpleasant effects are noticed. Screening smokes should not be released in inclosed spaces where heavy concentrations may result.

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

■ 8. How to Test for Odors.

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a. Set, Gas Identification, Instructional, MI.

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(3) *Method of testing.*

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(*c*) There is no danger associated with identifying chemical agents prepared in this way, provided that proper precautions are taken to prevent the activated charcoal from coming into contact with the person or clothing. The best results * * * gas reconnaissance detachments.

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

■ 9. General First-Aid Measures.

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e. Lung irritants.

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3. (Superseded.) *Disposition of personnel.*—During the period following exposure, and prior to development of symptoms, the disposition of personnel exposed to lung irritant agents is a command decision. The unit commander will decide whether such personnel shall receive prescribed first aid measures and be evacuated, or continued in action. The commander will base his decision on the tactical situation, the severity of exposure of personnel as known to him, and the recommendations of the medical officer.

(4) (Superseded). *First aid.*—If unmasked the mask should be adjusted while gas is present in the area. The mask should be removed as soon as the area is clear of gas. Ordinarily,

removal of personnel from the gassed area is neither necessary nor desirable. The clothing of the affected individual should be loosened, and the man kept completely still, relaxed, and warm with blankets. Nonalcoholic stimulants such as hot coffee or tea may be given. This type casualty should be evacuated on a litter to an aid station as soon as possible.

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i. First aid for vesicant casualties.

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(1) *Eyes.*—First aid for vesicants in the eyes consists of washing them freely and as quickly as possible with water from the canteen. This washing should * * * an aid station. If the agent can be identified as lewisite, eye ointment M–1 (or BAL) or eye solution M–1 will be used instead of washing. The eye can be most effectively irrigated by another man, but in the absence of immediate help, the individual must attempt to flush his own eye without delay. This is best done with the victim lying on his back, face up, and shielded from the ground by his protective cover. The injured eye is pulled open by traction on the lower lid with one hand, and water is slowly poured into the eye from the canteen held close to the eye with the other hand. The eye should be moved from side to side, and up and down, during the washing, which should be continued for about 5 minutes, if sufficient water is available. In vapor contamination of the eyes by nitrogen mustards the damage has already been done, and it is too late for effective removal of the agent. However, if a kit, first-aid, gas casualty, is available (on a combat or motor vehicle), item No. 4, eye and nose drops, may be used for the relief of eye or nasal pain.

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(3) *Skin* (Superseded).—(*a*) *General.*—In many instances there is a delay of some hours between the time when the chemical agent comes into contact with the individual and the time when he develops recognizable signs of injury.

(*b*) *Mustard gas.*—If liquid mustard gas is discovered on an individual's clothing, the contaminated spots will be cut from the clothing, or if grossly contaminated, the clothing should be

removed. If vapor is encountered while wearing nonimpregnated clothing, the clothing should be removed as soon as practicable. If impregnated clothing is worn it need not be removed. Soap and water will remove some of the poisonous vapor of the agent from the skin. If liquid has reached the skin, it should be blotted with ointment wrapping, dry gauze, or cloth. The protective ointment M4 is then rubbed thoroughly upon the affected area and the excess removed with a clean cloth. If this ointment is not available, bleaching powder or paste may be used. If bleaching powder or protective ointment is not available, the liquid agent may be removed by dabbing with a dry cloth. The skin should then be washed with soap and water. When bleaching powder is used, the most effective method of its application is to make a paste of a small quantity of the powder with water, the mixture being carefully stirred while being prepared. Usually equal volumes of water and powder are used. The contaminated area of skin is covered as well as the immediately surrounding area. The paste is rubbed in well for about 1 minute and then removed after not more than 3 minutes by flushing with a large quantity of water, if available. A subsequent bath with soap and water is desirable. Care must be taken not to get bleaching powder paste into the eyes. If the skin has already begun to show definite redness or blisters, the bleaching powder or protective ointment should not be used, as it is irritating.

(*c*) *Nitrogen mustards.*—If the liquid agents have contaminated the skin, protective ointment should be used as for other vesicant agents. Since the ointment merely dilutes and does not destroy nitrogen mustard, it is necessary as a final step to wash off the film of ointment with water, or preferably with soap and water. If the contamination is positively known to be due to nitrogen mustard, soap and water should be used for decontamination, but it is safer where doubt exists to use first the protective ointment, followed by soap and water or plain water. If reddening of the skin has appeared, the use of the ointment should be omitted and soap and water alone used. Blisters should not be opened until medical treatment is available. In vapor contaminations, the damage has already been done, and it is too late for effective removal of the agent. However, if a kit, first-aid, gas casualty, is available (on combat or

motor vehicle), item No. 6, pontocaine compound ointment, may be used to allay the irritation and itching of the skin.

(*d*) *Lewisite.*—Both the liquid and vapor of lewisite are highly vesicant, producing grayish discoloration, followed by blisters. Being a compound of arsenic, it is most important that first-aid measures be applied immediately, as serious arsenical poisoning may result from the absorption of arsenic through the skin. Contaminated clothing should be immediately removed and the bulk of the liquid lewisite blotted from the skin with cotton waste or cloth. After removal of contaminated clothing and liquid lewisite, the following first-aid measures may be used:

1. *Protective ointment.*—The protective ointment is effective in the treatment of liquid lewisite drops, provided the bulk of the liquid is blotted from the skin immediately after contact. The use of the ointment will lessen the lewisite burn if applied immediately.
2. *Hydrogen peroxide* (8 percent).—If available, the use of hydrogen peroxide is recommended. The hydrogen peroxide should be applied freely to the place contaminated with lewisite after the bulk of the agent has been blotted off with a cloth.
3. *Soap and water.*—Soap and water are more effective than water alone or a wet cloth.
4. Blisters should be protected from breaking.

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k. Systemic poisons.

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(*1*) *Hydrocyanic acid.*

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(*b*) (Superseded.) *First aid.*—The individual's mask should be properly adjusted and left on as long as the area is contaminated with gas. If the patient is not breathing, prompt artificial respiration should be given until medical aid is available. If in a closed space such as a room, dugout, tank, or pillbox, it is advisable to get into fresh air, as too great a concentration of hydrocyanic acid may penetrate the canister of the mask. If a kit, first-aid, gas casualty, is available (on a combat or other motor

vehicle) item No. 7, amyl nitrite, should be used. One ampule is removed from the carton and crushed in its woven jacket with the fingers. This is held close to the victim's nose and mouth, or thrust inside the gas mask facepiece. This procedure may be repeated three times at 3- to 5-minute intervals, meanwhile continuing artificial respiration until the victim breathes naturally. Keep the patient warm but out of the direct rays of the sun.

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

CHAPTER 5

USE AND CARE OF INDIVIDUAL PROTECTIVE EQUIPMENT

SECTION II ½ (ADDED)

LIGHTWEIGHT SERVICE MASK

■ *91.1.* DESCRIPTION.—The lightweight service mask differs from the older service mask in that it consists of a lighter canister (M10), a shorter hose, and the use of the M3 facepiece, which contains a nosecup in contrast to the M2 facepiece, now in common use.

■ *91.2.* CARRYING OF THE MASK.—The lightweight service mask may be slung in several positions, the most favorable of these being chosen to fit the occasion and the equipment carried. The positions of carry are *gas alert*, *back carry*, and *side carry*. In the *gas alert* position, where the mask is most readily available for use, the carrier is slung in front of the body on the chest. This position is favorable for drivers and occupants of motor vehicles (fig. 49.1⑤). It is one of the two positions of carry at which the facepiece can be worn. The *back carry* in one modification is suitable for Infantry, Medical Department, and other units carrying the pack (fig. 49.1⑨). In another modification the *back carry* is satisfactory for Cavalry and units when the pack is not worn (fig. 49.1⑩). The facepiece can be worn at the *back carry* only if the pack is also worn (fig. 49.2⑬). The *side carry* for general use may be modified by sliding the mask to the back of the left hip or to the front for carrying in the lap when seated (fig. 49.1① and ⑧). The facepiece can be put on with the carrier at the *side carry*, but this position is not satisfactory while the facepiece is being worn; the carrier must be brought up to the *gas alert* (fig. 49.2⑩ and ⑪).

a. To sling carrier at gas alert.—The command is: 1. GAS ALERT, SLING, 2. MASK. At the command MASK, hold the carrier by shoulder strap in the left hand, the flap of carrier facing away from the body (fig. 49.1①). With both hands, swing strap over the head, at the same time passing left elbow through loop to position at side (fig. 49.1②).

TWO. Shorten shoulder strap by hooking harness snap into D-ring at carrier (fig. 49.1③). The carrier is then in position at an angle on the left side of the chest. (See note 1.) Adjust the body strap to pass around the body and fasten to the small D-ring at bottom of carrier (fig. 49.1④ and ⑤). (See note 2.)

b. To sling mask at back carry.—The command is: 1. BACK CARRY, SLING, 2. MASK. At the command MASK, the first count is the same as for the *gas alert carry.*

TWO. Shorten strap by hooking harness snap into D-ring at carrier (fig. 49.1③). Slide carrier around under the left arm to position on the back (fig. 49.1⑥). Adjust the body strap around equipment and fasten to the sliding D-ring on the shoulder strap (fig. 49.1⑦). (See notes 1, 2, and 3.)

c. To sling mask at side carry.—The command is: 1. SIDE CARRY, SLING, 2. MASK. At the command MASK, the first count is the same as for the *gas alert carry.*

TWO. Allow the shoulder strap to remain extended. Adjust the body strap to pass around the body and fasten to the small D-ring at bottom of carrier. Place carrier at left side (fig. 49.1④). If desired, slide the carrier to the back of the left hip or to the front for carrying in the lap (fig. 49.1⑧ and ⑨).

d. To move carrier from one carry position to another.—The command for the new position is given in the same manner as if carrier were unslung. For example, from *back carry* to *gas alert carry*, the command is: 1. GAS ALERT, SLING, 2. MASK. Unfasten body strap, move carrier to new position, and refasten body strap as prescribed for position assumed.

e. To unsling mask.—The command is: 1. UNSLING, 2. MASK. Unfasten body strap. Unfasten harness snap on shoulder strap if snap is in use. With both hands, grasp shoulder strap and raise and slide over the head. Hold the shoulder strap in left hand with the flap of carrier away from body (fig. 49.1①).

NOTES.—1. In adjusting the shoulder strap, the shoulder strap slide should be adjusted so that the carrier will be about at the waist line. The shoulder strap harness snap should be adjusted so that when the strap is shortened the carrier will be well up on the chest.

2. When wearing this mask with full field equipment, the pack is slung first and then the mask.

3. When the mask is slung at *back carry* with the pack, the carrier is positioned at the left of the pack resting against its side and well up. (fig. 49.1⑩). Without the pack, the carrier is positioned at an angle across the back (fig. 49.1⑩).

■ 91.3. To Adjust the Mask.—*a.* (1) The mask being slung, the command is: GAS. At the command GAS, the carrier must be moved to the front of the body if not already there. If slung at *back carry* (figs. 49.1⑨ and ⑩), unfasten body strap and slide carrier to front in *gas alert* position. The shoulder strap may be left in either the extended or shortened position. Dispose of arms, etc. Remove and dispose of head covering (fig. 49.2①). Open flap of carrier with either hand (fig. 49.2②). Grasp the facepiece above the eyepieces with the right hand (fig. 49.2③) and remove from the carrier. Grasp facepiece with both hands, sliding first the left then the right thumb up inside the facepiece at the edge and under the lower and middle head harness straps. The fingers are placed straight and together on the facepiece almost above the eyepieces (fig. 49.2④). The thumbs are on the facepiece on the inside (fig. 49.2⑤). Bring facepiece up in front of the face. Thrust out the chin. (See notes 1, 2, and 3.)

TWO. Seat chin pocket of facepiece firmly on the chin, holding the head stationary. Sweep head harness smoothly over the head (fig. 49.2⑥). Check to make sure all head harness straps are straightened out.

THREE. Close the outlet valve by placing the palm of the right hand firmly over the valve and exhale vigorously to clear the facepiece of gas (fig. 49.2⑦). Check the mask by pinching the hose near the canister to shut off the air supply (fig. 49.2⑧). Inhale. No air should enter and the facepiece should tend to collapse against the face. (See note 4.)

FOUR. Replace headpiece. Fasten the flap of carrier so that the hose comes out at the left or right depending upon the position in which the carrier is to be placed (fig. 49.2⑨).

(2) If the carrier was previously slung in any position except the back carry with pack, it will be placed at the gas alert carry (figs. 49.2⑩ and ⑪). The hose should come out at the right of carrier. The shoulder strap is shortened, if not already, by engaging the harness snap. The body strap is fastened and original equipment retaken.

(3) When the mask has been carried at *back carry* with the pack, it will ordinarily be returned to the *back carry*. The hose should come out at the left of the carrier, the shoulder strap is extended by unfastening the harness snap and the carrier

moved to the rear. Bring the left arm between the hose and body. The shoulder strap is again shortened by engaging the harness snap (fig. 49.2(12)). The carrier is brought up in position at the left of the pack so that the hose comes over the left shoulder (fig. 49.2(13)). The body strap is refastened, around the pack, to the sliding D-ring on shoulder strap. (See notes 5, 6, 7, and 8.)

NOTES.—1. Without the numbers, at the command GAS, immediately stop breathing. Ability to hold the breath for 30 seconds or more under conditions of excitement should be developed. Do not take another breath, even if the breath has just been exhaled, until the facepiece is adjusted and cleared.

2. Dismounted troops armed with or carrying weapons and equipment will immediately dispose of equipment and free both hands without permitting any part of the equipment to touch the ground unless absolutely necessary. Mounted troops and animal drivers will halt and temporarily free both hands by disposing of the reins in such a manner as to prevent the mount or team from bolting.

3. After disposing of weapons during adjustment of the gas mask, pass the head or chin strap of head covering over the left forearm. Soft cloth caps and headpieces without head or chin straps will be tucked in the waist or cartridge belt or between the carrier and the body.

4. For adjustment without the numbers, resume normal breathing as soon as the mask is cleared, seated, and checked.

5. Headpieces having chin strap which can be unfastened will be placed under the chin and refastened, otherwise the chin or head strap will be adjusted to the back of the head.

6. Weapons or equipment will be brought to the original position.

7. Mounted troops and drivers will dismount and adjust animal masks.

8. When the toque and/or hood are worn, the following modifications of gas mask drill are necessary:

b. To adjust mask.—At the command GAS, dispose of arms, etc., and remove headpiece in the following manner: insert thumb of right hand between chin strap and cheek, slide thumb down and remove chin strap from under chin. Using both hands, lift helmet off head with a backward sweep to prevent neckband binding. Dispose of helmet by hanging it by the chin strap over left arm. If knitted cap is worn, remove it from head and place in helmet. If toque and hood are worn, open front and push hood off head, letting it hang about neck. If toque has front that can be opened around neck, open front and push back over head at the same time hood is removed. If toque

does not have front opening, remove and thrust it, neck first, over the right arm, extending the right hand through the face opening. Remove facepiece from carrier in the usual manner and draw it through the face opening of toque and push toque down over hose. Place the facepiece on the head and after clearing the facepiece, put the toque on the head. Replace the hood and helmet by unhooking the helmet strap and refastening it under chin.

c. To test for gas.—If toque and hood do not open, thrust the first two fingers of the right hand under the toque and hood and pull facepiece away from right cheek. Test for gas as described.

d. To remove mask.—Unhook chin strap of M1 helmet. Using both hands, lift helmet off head with a backward sweep. Refasten chin strap and hang helmet by chin strap over left arm. If knitted cap is worn, remove it from head and place in helmet. If toque and hood open in front, open and push back off head to hang about neck. Remove facepiece and grasp top of facepiece with the right hand and carry toque up over facepiece and on right arm. Replace facepiece in usual fashion. Replace headgear.

■ 91.4. To Test for Gas.—The facepiece being adjusted, the command is: TEST FOR GAS. Take a moderately full breath, exhale part of the air breathed, and stop breathing. Stoop to bring the face as close to the ground as possible without touching any part of the person or equipment to the ground. Break the seal of the facepiece by grasping one of the lower or middle head harness tabs near the rivet and pulling the facepiece away from the face. This will allow air to enter without touching the finger to the skin, since the finger may be dirty or contaminated with chemicals. Sniff gently but do not inhale (fig. 49.3①). Resume the erect position. Clear the facepiece as prescribed in the adjustment for the count of THREE (fig. 49.2⑦). Resume normal breathing.

Notes.—1. Personnel will be taught to test for gas habitually before removing the mask.

2. If mounted, dismount.

■ 91.5. To Remove and Replace Mask.—IMPORTANT. The mask, if contaminated with chemical agents, must not be re-

placed in the carrier, but should be hung up to air or be otherwise decontaminated. The mask having been adjusted the command is: 1. REMOVE AND REPLACE, 2. MASK. *Important: First, test for gas as prescribed in paragraph 91.4* (fig. 49.3①). (See notes 1 and 2.) If no gas is detected, lift the headpiece with the left hand, and with the right hand grasp the facepiece below the eyepieces (fig. 49.4①). With a downward, outward, and upward motion, remove the facepiece. Place in the crook of the left elbow or, if carrier is on the back, allow the facepiece to hang over the left shoulder. Replace headpiece, using both hands (fig. 49.4②).

TWO. (If carrier is slung at the back, unfasten body strap and slide carrier to gas alert carry position.) Grasp facepiece with the right hand. Place head harness in facepiece (fig. 49.4③). Open the carrier with the left hand while steadying it with the hand holding the mask (fig. 49.4④). Grasp the canister with the left hand and straighten out the canister straps. The thumb is on top of the canister with the fingers underneath. Loop the hose around the canister lengthwise in such a manner that the canister can be placed inside the facepiece with the canister inlet valve at the chin of the facepiece (fig. 49.4⑤). Grip the canister through the facepiece above the eyepieces with the right hand and start the hose loop into the carrier (fig. 49.4⑥).

THREE. Place the mask in the carrier and fasten the flap (fig. 49.4⑦. Return the carrier to the original carrying position or to a different position if designated.

NOTES.—1. If wearing a helmet, prepare the headpiece for removal by unsnapping the chin strap.

2. Arms and equipment will be placed in the most convenient way to free both hands while removing the mask. If possible, avoid grounding arms or equipment.

■ 91.6. TO CHECK FIT OF MASK.—The facepiece being adjusted, the command is: 1. CHECK. 2. *MASK*. At the command MASK, pinch together the walls of the hose near the canister. Exhale, then inhale. No air should enter. (See notes 1 and 2.) The outlet valve should permit free escape of air. (See note 3.)

NOTES.—1. To adjust the head harness for a correct fit of facepiece, first loosen all six straps. Put facepiece on with straps loose and hold firmly against the chin with one hand. Center the head harness pad fairly well down on the back of the head. Adjust the middle pair of

straps by tightening evenly until the buckles lie flat. The ends of the straps should be the same length. The straps should clear the top of the ears and be just snug, not too tight. Adjust the top pair and the bottom pair to the same tension as the middle pair of straps. Check mask to test the fit. If the mask does not fit, the top pair may be drawn up a bit tighter; or if the individual has prominent hollows at the temple, the middle pair may need further adjustment.

2. If the facepiece allows air to enter at this time, two possible faults are indicated:

a. If the leakage is noticed between the edges of the facepiece and the face, faulty adjustment and fitting are probable. Such a fault may be overcome by pressing the edges of the facepiece to the face and readjusting head harness by carefully pulling up each of the opposing pairs of head harness straps a little at a time. A mask adjusted too tightly may cause a channel at the edge of the facepiece through which the gas may enter. Headaches and discomfort on prolonged wearing may result.

b. If adjustment of the head harness fails to stop the leak, it is possible that a hole or rip in the hose, outlet valve, or facepiece may have developed, and a minute visual inspection of the gas mask is necessary.

3. Outlet valves occasionally stick and cause exhaled air to pass out between the facepiece and the face, especially during very cold weather or after the mask has been disinfected. In case of a sticking outlet valve, remove the facepiece and open the valve ports with a match stick, but be careful that the valve is not injured or torn in so doing. Talcum powder sprinkled on the inner surfaces of the outlet valve will prevent further sticking. Readjust the facepiece.

■ 91.7. MASK INSPECTION.—Checking the mask as described is not a conclusive test of its serviceability. During the execution of the command CHECK, MASK, if the facepiece fails to cling to the face and a leak is indicated, a minute visual inspection must be made. Visual inspections must also be made upon receipt of the masks and periodically thereafter for cleanliness and condition of the several parts of the gas mask. This inspection is made by the individual wearer. It is not executed as a precision drill, but will be taught in the following manner:

a. To inspect mask.—The command is: 1. INSPECT, 2. MASK. Remove facepiece from carrier or face and hang it over left shoulder. Remove the canister from the carrier. Examine canister straps and check antidim. Examine canister. (See note 1.) Examine hose. (See note 2.) Replace canister in carrier. Minutely and carefully examine the eyepieces, outlet valve, facepiece, and head harness. (See notes 3, 4, 5, and 6.)

Persons with defective or faulty masks will report to the instructor. All others will replace facepieces.

NOTES.—1. Serious defects in the canister are indicated by holes through the canister body, excessive rust and corrosion, and by loose or rattling contents. (Normally, the canister does not make any sound when shaken.) Rust or corrosion may be caused by water in the interior of the canister, resulting in caked and damaged contents. This will lower the chemical efficiency and cause marked increase in breathing resistance. Such a canister will be exchanged. Minor defects in the canister are faulty inlet valves and loose connections to the hose. These can be repaired in the organization.

2. Hose may develop holes, splits, and tears due to accident. These may be temporarily patched in the field in an emergency, but should be replaced as soon as possible. Improper storage and incorrect placement of the hose in the carrier often cause kinks, undue stretching or tackiness, and permanent set of the rubber. Such hose should be replaced.

3. If incorrectly stored, rubber of outlet valves may become sticky or tacky and later hard and cracked with a permanent set. Defective valves will be replaced. Occasionally, after disinfection, and also during freezing weather, the edges of the valve disk will freeze or stick, causing very high resistance to exhalation. When this happens, it is necessary to examine the valve and carefully open the ports.

4. Facepieces are affected by improper storage and careless use. The rubber may, unless correctly placed in the carrier, take a permanent set and form leakage channels around the edges. Head harness attachments may become torn or loosened. Cracks and splits sometimes develop near the eyepieces. Eyelenses sometimes are badly scratched. Unless the damage is too great, facepieces usually can be repaired within the organization.

5. If head harness is adjusted too tight or with too great tension during drills and wearing exercises, the rubber threads of the elastic straps may break. Improper storage may cause the rubber threads to deteriorate and lose elasticity. A defective head harness should be replaced.

6. Inspection of the carrier is habitually performed whenever the mask is to be laid away. The carrier should be inspected for tears or rips in the fabric, for broken or missing metal parts, and to insure that protective covers, protective ointment, and antidim are present. The carrier may also be inspected at such other occasions as are deemed necessary.

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

FIGURE 49.1①.—Sling mask starting position.

FIGURE 49.1②.—Sling mask, completion of first count.

FIGURE 49.1③.—Gas alert position, shortening shoulder strap.

FIGURE 49.1④.—Side carry position.

FIGURE 49.1⑤.—Gas alert position driver of motor vehicle.

FIGURE 49.1⑥.—Back carry position, sliding carrier to back.

FIGURE 49.1Ⓒ.—Back carry position, fastening body strap.

FIGURE 49.1©.—Side carry position, modified, carrier in lap.

FIGURE 49.1(a).—Back carry position, with pack and carbine.

FIGURE 49.1⑩.—Back carry position, without pack, rear view.

FIGURE 49.2①.—Removal of helmet.

FIGURE 49.2②.—Opening flap of carrier.

FIGURE 49.2③.—Removing facepiece from carrier.

FIGURE 49.2④.—Fingers straight and together.

FIGURE 49.2⑤.—Thumbs inside the facepiece.

FIGURE 49.2(B).—Sweep head harness over the head.

FIGURE 49.2Ⓣ.—Clear the facepiece.

FIGURE 49.2Ⓢ.—Check the mask

FIGURE 49.2©.—Fasten carrier.

FIGURE 49.2(10).—Mask adjusted, carrier at gas alert, driver of vehicle.

FIGURE 49.2(9).—Mask adjusted, carrier at gas alert, mounted.

FIGURE 49.2(2).—Shortening shoulder strap.

FIGURE 49.2(15).—Mask adjusted, carrier at back carry with pack.

FIGURE 49.3.—Testing for gas before removing mask.

FIGURE 49.4(3).—Lift headpiece and remove facepiece.

FIGURE 49.4©.—Replacing helmet, facepiece in crook of left elbow.

FIGURE 49.4③.—Placing head harness in facepiece.

FIGURE 49.4④.—Opening carrier.

FIGURE 49.4⑤.—Looping hose around canister.

FIGURE 49.4©.—Starting hose loop into carrier.

FIGURE 49.4⑦.—Fastening the carrier.

■ 108.1. (Added.) CLEANING OUTLET VALVES.—*a. General.*—Outlet valves of masks will leak when coated or clogged with dust, sand, or other foreign matter. Gas enters the facepiece. Outlet valves will, therefore, be kept clean and free of foreign matter.

b. Cleaning.—(1) Outlet valves can usually be cleaned by wiping them with a dry cloth, or a cloth moistened with warm water may be used if necessary.

(2) In the disk type outlet valves both the rubber disk and the valve seat will be cleaned. If the valve has a valve guard, the guard may be removed by unscrewing it to facilitate cleaning. If the valve guard should be cemented in place, procedures to be followed are those recommended in paragraph 42¾, TM 3–205.

(3) Outlet valves other than disk type will be cleaned by wiping the outside of the rubber valve and carefully cleaning the ports with a cloth wrapped around a small wooden stick.

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

■ 114. USE.

* * * * *

a. Impermeable clothing.—Impermeable suits are made of coated materials which will not allow liquid vesicants or vapors to pass readily through them. They afford complete protection from vapors or any size drops of liquid vesicants for varying periods of time. It should be borne in mind, however, that the nitrogen mustards, in liquid form, penetrate rubber gloves and rubberized fabrics with greater rapidity than does ordinary mustard gas. Since there is * * * are likewise worn.

b. Permeable clothing.—The permeable type of clothing consists of garments treated in such a manner that they will protect the wearer from field concentrations of vapor and small drops of vesicant chemical agents. Large drops will exhaust the chemical in the clothing at the point where the liquid wets the fabric, and some of the agent will then penetrate to the body of the wearer. Protective clothing reacts in the same way to drops of ordinary mustard gas, nitrogen mustard, and to lewisite. It is to be noted, however, that lewisite is approximately 45 percent heavier than ordinary mustard

gas; consequently, the drops of lewisite against which the clothing gives complete protection are somewhat smaller than those of ordinary mustard gas. The ordinary field * * * also be worn.

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

Section IX (Added)

EYESHIELD

■ 125.1. Purpose.—Eyeshield M1 is designed for the protection and use of troops in the theater of operations against chemical spray attack by enemy aircraft. Its use may be extended to protection of the eyes against dust, wind, or blown sand.

a. Description.—The eyeshield (fig. 100.1 is a one-piece, flexi-

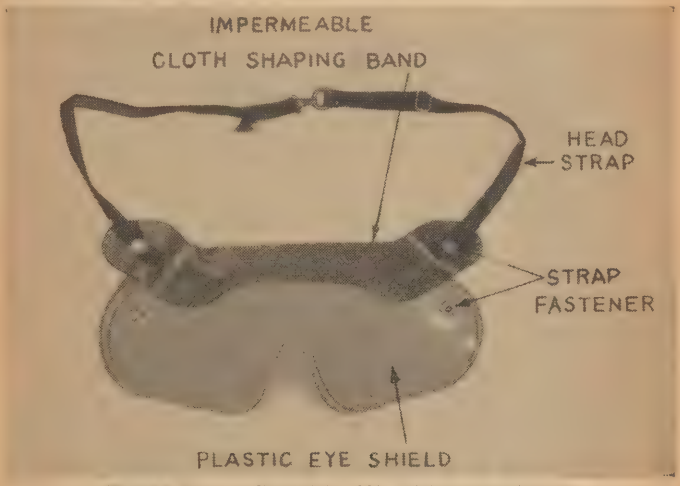


Figure 100.1.—Eyeshield, M1, with nomenclature.

ble, transparent, plastic goggle cut to fit closely over the bridge of the nose and around the eyes. It is held in place over the eyes by a headstrap which the wearer may adjust so that the eyeshield will fit comfortably (fig. 100.2). One section of the headstrap is of elastic tape while the remainder is of cotton webbing. Eyeshields are issued in a waterproofed, open-end envelope to each soldier in the theater of operations, and will be

FIGURE 100.2.—Eyeshield adjusted.

carried in the gas mask carrier. Eyeshields are expendable and will be discarded when contaminated.

b. Use.—The eyeshield is worn whenever enemy airplanes are known to be in the vicinity or at any other time when protection for the eyes is needed. When personnel are contaminated by liquid agents, they must first decontaminate and apply protective ointment before changing eyeshields. As soon as a contaminated eyeshield is removed and discarded another should be adjusted in preparation for any recurrence of the attack. The eyeshield is not designed to fit beneath the gas mask and should be removed prior to adjusting the mask. The face must be decontaminated before the mask is adjusted.

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

■ 126. PERSONAL PROTECTIVE MEASURES.—*a. Protective ointments* (Superseded).—Protective ointments will be used as a first-aid measure only AFTER contamination by vesicant liquids, and not as a preventive. Instructions printed in training literature and on tubes of protective ointment which state that these ointments may be used as a "preventive" or "protection" against vesicants, or which state that the ointment is to be "mixed well with vesicant on skin," are rescinded.

(1) *Description.*—Protective ointments M1, M2, M3, and M4 are issued in collapsible tubes which in turn are packed in individual cardboard containers. A quantity of absorbent tissue accompanies ointment M4.

(2) *Instructional use.*—Instructional use of protective ointments in training will be limited to three successive applications of the ointment, as repeated use will cause serious irritation. The ointment should not be applied to the tender areas of the body, such as the scrotal regions, during training or for test purposes.

(3) *Use.*—Ointments are to be used similarly and MUST be applied immediately, or within a very few minutes, following liquid contamination of the skin in order that the greatest benefit may be obtained. If reddening of the skin has already occurred, ointment will not be applied. Protective ointments may be used on any areas of the body EXCEPT the eyes, with care being

exercised to keep ointment out of the eyes. Three steps of decontamination are desirable:

(*a*) *First.*—Dry absorbent tissue is carefully applied in a blotting or dabbing manner to remove agent from the skin. Extreme care must be exercised by the individual not to spread the agent to uncontaminated areas.

(*b*) *Second.*—A quantity of protective ointment, sufficient for the area contaminated, is squeezed on the contaminated skin area, rubbed with the fingers for approximately 15 seconds, and then wiped off. This is done three times without interruption.

(*c*) *Third.*—When practicable the area is finally washed with soap and water.

* * * * *

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

■ 127. DETECTION DEVICES.—Since mustard gas, nitrogen mustards, and lewisite may be made practically odorless, detection devices are necessary for warning against these agents. For this purpose, * * * are described below.

a. Paint, liquid vesicant detector M5.—This paint is to be applied by brush or spray to surfaces suitable for painting, such as fences, lamp posts, helmets, hoods and fenders of vehicles, or other material readily visible in areas where vesicants might be used, in order to render them sensitive to liquid vesicant spray. It should constitute part of the camouflage pattern on helmets and on hoods and fenders of vehicles. Although the paint is touch dry within 2 hours, a considerably longer time is required for complete dryness. For this reason all painting should be carried out in the very late afternoon, dusk, or early evening to permit overnight drying. The wet paint loses much of its sensitivity to vesicant agents if exposed to the heat of the sun. The length of life of the paint under continuous exposure to severe conditions of heat and sun can safely be regarded as 1 week. Under milder conditions the life is much longer, extending, under temperate conditions, to months. The color of the paint is yellow after its usefulness has been destroyed by light. It should be understood that conditions which cause the deterioration of ordinary paint will also affect the detector paint. Ordinary paint has a longer life than detector paint. In the desert or jungle it is difficult to predict exact durability of detector paint due to lack of knowledge of the amount of abrasion by sand or thick vegetation. Rough handling of detector-painted surfaces will likewise decrease the life of the detector paint. It should therefore be remembered that under severe conditions helmets and vehicle surfaces should be repainted each week. Conditions of extreme heat, above 150° Fahrenheit, will cause the paint to turn reddish-brown. This does not destroy the value of the paint, for the color produced by vesicants is still easily visible on this reddish-brown color, but the surface may have to be repainted for camouflage purposes. The paint is * * * wherever they strike.

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

■ 130. WATER TREATMENT.

* * * * *

b. Water that is * * * water supply battalion.

NOTE (Added).—Since the senses are unreliable to detect nitrogen mustards, and since the usual methods of detection of these agents are not applicable to contaminated water, when areas immediately adjacent to small bodies of water are found to be contaminated by the nitrogen mustards, the water must also be considered contaminated. However, dangerous contamination of a large body of water or of a rapidly flowing stream is unlikely.

* * * * *

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

■ 132. FOR MUSTARD GAS.

* * * * *

b. Chlorinated lime (bleaching powder).

* * * * *

(3) (Added.) A "brush-and-bucket" method consists of mixing the 50–50 slurry in a 14-quart galvanized iron bucket. If mixed by volume rather than by weight, 5 shovelfuls of chlorinated lime are used with 3 gallons of water. A mixture of thick, pasty consistency is suitable for walls but should be diluted for horizontal surfaces. The slurry is applied to surfaces with brushes or swabs. Complete coverage is necessary, followed by scrubbing to dislodge vesicant and fill cracks with slurry. If practicable, the slurry should remain in contact with the contaminated surface for 6 to 24 hours, after which it should be removed by washing down, scrubbing, and rinsing with water.

* * * * *

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

■ 133. FOR LEWISITE AND OTHER ARSENICALS.—Decontamination for lewisite * * * in the area. After treatment with water, a lewisite area should, if practicable, be covered with a layer of earth, sand, or ashes, *and matériel treated with a caustic solution, such as washing soda or lye.*

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

■ 137. DECONTAMINATING APPARATUS, 3-GALLON.—The 3-gallon pressure * * * noncorrosive decontaminating agent. The apparatus is * * * the required pressure. It is best used when decontaminating matériel rather than contaminated ter-

rain. Bleach slurry, formerly applied with this apparatus will no longer be used in this equipment but will be applied by the "brush-and-bucket" method. In no instance will noncorrosive decontaminating agent be stored in the apparatus. Instead, any unused solution will be dumped, the apparatus drained, and then rinsed thoroughly twice with acetylene tetrachloride. The acetylene tetrachloride will then be permitted to evaporate completely before the apparatus is reassembled.

[A. G. 300.7 (2 Jul 43).] (C 1, 11 Sep 43.)

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

U. S. GOVERNMENT PRINTING OFFICE: 1943

BASIC FIELD MANUAL *C 2

DEFENSE AGAINST CHEMICAL ATTACK

CHANGES No. 2

WAR DEPARTMENT,
WASHINGTON 25, D. C., 20 December 1943.

FM 21–40, 7 September 1942, is changed as follows:

■ 36. ALARMS.

* * * * * * *

b. Local.—Local alarms are * * * gas is recognized. Except in the case of airplane spray attack, *c* below, they are usually given only with alarm devices which produce a sound not easily confused with other sounds encountered in combat. Alarm devices of this type may include the gas alarm M1 (fig. 14.1), or the British gas rattle. Bells, metal triangles, steel rails, pipes, or empty 75-mm or 105-mm shell cases, when struck rapidly and continuously with an iron or steel striking rod, may be used as improvised alarms. All personnel should * * * its distinctive sound.

c. (Added.) *Warning of airplane spray attack.*—(1) In the event of airplane spray attack, warning will be given immediately by the cry of "SPRAY."

(2) This warning cry of "Spray" will be given *only* when attacking aircraft are actually observed to begin a spray attack.

(3) When the cry of "Spray" has been given, other types of gas alarm will *not* be sounded unless a heavy concentration of vapor occurs.

[A. G. 300.7 (14 Sep 43).] (C 2, 20 Dec 43.)

■ 44. DIVISION CHEMICAL OFFICER.

* * * * * * *

g. (Superseded.) When conditions warrant, a situation map will be prepared and maintained by the division chemical officer. This map will embrace the area over which the division is operating, together with so much of the adjoining area as may be necessary for a proper understanding of the situation. The scale of the map should be the same as that of the map used by the division G–2 or G–3 in preparing G–2 or G–3 overlays. The situation map should show at all times the areas where chemical agents have been laid down by the enemy and also

*The individual items in this change will be cut apart and pasted over the specific paragraphs or subparagraphs affected.

563064° -43

FIGURE 14.1.—Gas alarm M1.
[A. G. 300.7 (14 Sep 43).] (C 2, 20 Dec 43.)

by friendly troops. Provision must be made to indicate the type of gas used, the relative degree of contamination (in the case of persistent gases), and the date the gas was laid down or the contaminated area discovered. Division boundaries, certain important installations, and items of like nature should be shown as well as other data which may be pertinent to the particular situation. However, items which may change frequently, such as troop dispositions, which are usually shown on G–2 or G–3 overlays, should not be shown on the gas situation map. In those cases where it is desirable to include frequently changing data on the map a sheet of acetate film may be fixed in place over the map and data inscribed on this sheet

with wax pencils. These inscriptions can easily be removed at any time by rubbing with a cloth. All possible sources of information will be used in order that the data included on this map will be complete, accurate, and up to date. One of the enlisted men of the division chemical section should be specially trained for the purpose of preparing and maintaining the gas situation map and doing other work of a similar nature. (See FM 3–5.)

[A. G. 300.7 (14 Sep 43).] (C 2, 20 Dec 43.)

■ 52.1 (Added) FIELD DUTIES.—*a.* In the field, whenever there is danger of gas being used, each gas noncommissioned officer should have with him at all times a supply of liquid vesicant detector paper or vesicant detector crayons. Whenever making a reconnaissance, a gas noncommissioned officer should be supplied with containers for collecting samples of contaminated earth or other material. He should also be provided with equipment for marking contaminated areas (placards, signs, or similar improvised markers).

b. On the march, a gas noncommissioned officer, provided with a chemical agent detector kit, should always accompany the point of the column. When deployment appears imminent, gas noncommissioned officers with chemical agent detector kits, if available, should accompany flank patrols. When deployed, one of the company gas noncommissioned officers should remain habitually in the neighborhood of the company commander in order to be immediately available in any situation where gas is used. Similarly, the battalion and regimental gas noncommissioned officers should remain in the vicinity of the gas officers whose assistants they are. Wherever possible, these gas noncommissioned officers should carry chemical agent detector kits.

c. In addition to other duties, all gas noncommissioned officers will assist when necessary in first aid procedures for gas casualties.

[A. G. 300.7 (14 Sep 43).] (C 2, 20 Dec 43.)

■ 119.1 (Added) TEST FOR PROTECTIVE VALUE.—The kit, testing, impregnite in clothing, M1 provides a method for determining when impregnated clothing no longer affords adequate protection against blister-gas vapors or droplets. The test can be used in the field, as well as for clothing in storage or at laundry installations.

a. Description.—The complete test kit (fig. 99.1) consists of an olive drab cotton-duck kit, 6½ inches wide, 4½ inches high, and approximately 1 inch thick. It weighs about 1 pound. Two loops for attachment to waist belt are provided.

b. Contents.—The contents of the kit include the following:

(1) Solvent, in 1-ounce bottle. (Bottle A.)

(2) One heavy-glass eye dropper for solvent.

(3) One-ounce bottle (Bottle B) with eye dropper. This bottle contains two white tablets. These tablets are dissolved in water (*c* below) to prepare the test solution.

(4) Book of test papers.

(5) One-ounce bottle (Bottle C) with eye dropper. This bottle contains two light-orange-colored tablets. The tablets are dissolved in water (*c* below) to prepare the neutralizing solution.

(6) Soft, black pencil for marking spots on garments.

(7) Instruction card with complete directions for test.

c. Preparing solutions.—When the kit is to be issued from the depot the bottles containing the tablets (Bottle B and Bottle C) will be filled with clean rain or well water, or preferably with distilled water, to within about ¼ inch of the lower part of the neck of the bottle, and the bottles rotated or shaken until the tablets dissolve. ***Caution:*** Chlorinated water must not be used. The neutralizing solution tablets are colored with a dye to distinguish them from the test solution tablets. This dye colors the neutralizing solution greenish yellow.

d. Test procedure.—(1) Place one drop of solvent (Bottle A) on the cloth to be tested.

(2) Place one drop (no more) of test solution (Bottle B) on the spot wetted by the solvent.

(3) After 2 or 3 seconds (not over 10 seconds), blot the liquid from the cloth with a piece of test paper. Use firm pressure while blotting and make certain that the liquid from the cloth is taken up by the paper.

(4) Remove the paper from the cloth and compare the extent of the color patch developed on the paper with that shown in figure 99.2.

(*a*) Positive results, indicating that the cloth has good protective value, are characterized by a blue-black color developed throughout all or the greater portion of the spot on the paper (A and B, fig. 99.2).

FIGURE 99.1.—Kit, testing, impregnite in clothing, M1.

[A. G. 300.7 (14 Sep 43).] (C 2, 20 Dec 43.)

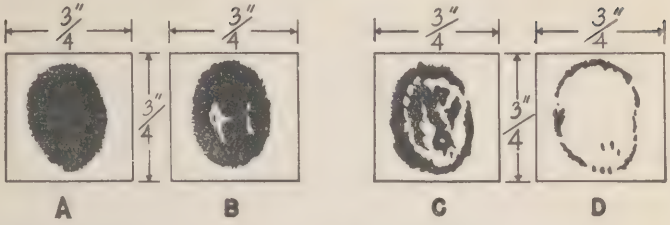


FIGURE 99.2.—Test results.

[A. G. 300.7 (14 Sep 43).] (C 2, 20 Dec 43.)

(*b*) Negative results, indicating that the garment is low in protective power, may show a ring of color formed around the edge of the spot, with scattered color within the ring (C and D, fig. 99.2), or, where the impregnite content is unusually low, may show no color at all. If there is doubt about a result, the test should be repeated.

(5) After the test has been completed, place a drop of the neutralizing solution (Bottle C) on the tested spot of the garment and allow it to soak into the cloth. The spot is then marked with the black pencil to avoid retesting the same area.

e. Portions to be tested.—Sections of clothing subjected to the effects of friction and perspiration should be used as key points for testing because the impregnite content deteriorates more rapidly in such parts.

f. Selection of test garments.—Clothing for test should be representative of a lot which has been stored or worn under approximately the same conditions. The results can then be taken as indicating the condition of the entire lot.

g. Number to be tested.—Following is the proportion of garments to be tested under certain conditions:

(1) From storage: at least ½ of 1 percent (1 percent of clothing taken from storage for issue).

(2) After 2 weeks' wear, if not laundered, and not to be laundered before additional wear: at least 5 percent.

(3) After each laundering: at least 5 percent.

(4) After exposure to blister-gas vapor: at least 10 percent.

h. Disposition of clothing.—(1) When one-half or more of the tested garments show negative results, reimpregnation of the entire lot is necessary.

(2) When more than one-half of the test garments show positive results, and the remainder show the presence of some impregnite (C, fig. 99.2), reimpregnation is not necessary.

(3) When more than one-half of the test garments show positive results, and a high percentage of the remainder show the presence of very little or no impregnite (D, fig. 99.2), the lot should be reimpregnated, or each garment tested and the lot sorted.

[A. G. 300.7 (14 Sep 43).] (C 2, 20 Dec 43.)

■ 133.1 (Added) USE OF PROTECTIVE OINTMENT.—Protective ointment M1, M2, M3, or M4 may be used for the *emergency* decontamination of individual weapons and certain items of individual equipment as follows:

a. Weapons.—(1) Wipe dry of all liquid contaminants (H, L, etc.) and bury or burn wiping material.

(2) Spread ointment well over all contaminated metal, wood, and leather surfaces, rub vigorously, and allow to remain for 15 minutes.

(3) Wipe all surfaces dry of ointment.

(4) As soon as tactically permissible, disassemble the weapon, clean thoroughly, oil all metal parts, and reassemble.

b. Entrenching tools.—(1) Scrape off any contaminated earth or other material that may be upon the tools.

(2) Apply ointment to all contaminated surfaces except the blade, and allow to remain for 15 minutes.

(3) Wipe all surfaces dry of ointment.

(4) Remove liquid contamination from the blade by plunging the blade several times into earth or sand until clean.

c. Gas mask.—(1) *Facepiece.*—Both exterior and interior of the facepiece and valves will be wiped dry of liquid contamination, coated with ointment, and this wiped off after 15 minutes. To be most effective, ointment must be applied within 3 minutes after contamination. Ointment will not be used on the eyepieces because it will etch them severely. (Eyepieces will be decontaminated, so far as possible, by rubbing, first with a dry cloth or absorbent paper, next with a damp cloth, drying and applying antidim.) Care should be taken to insure that the interior of the facepiece is wiped dry of ointment, and that no ointment is permitted to remain within the valves, or clogging

will result. Any odor of ointment detected during subsequent wearing of the mask may be disregarded. A contaminated gas mask will be treated daily with ointment, as outlined above, until it can be completely decontaminated by other means.

(2) *Hose.*—Ointment will be used to decontaminate the hose. To be wholly effective, ointment must be applied immediately after contamination. This will likewise prevent contamination by the hose of the inside of the facepiece. It should be thoroughly understood, however, that only one surface of the hose (the outside) can be treated with protective ointment. It is therefore impracticable to use ointment to decontaminate a heavily contaminated hose. Vesicant liquid will be quickly absorbed by the hose and produce vapor within.

(3) *Carrier, gas mask.*—As too large a quantity will be required for effective decontamination, ointment will not be used to decontaminate the gas mask carrier. Instead, the carrier will be decontaminated by aeration or scrubbing with soap and water.

d. Leather.—The leather chin strap of the helmet and the leather holster may be decontaminated by ointment in the same manner as other items.

e. Clothing.—Protective ointment will be used to decontaminate clothing which is lightly contaminated with not more than 20 to 30 drops of mustard gas or other blister gas. The ointment will be applied to both sides of the cloth and rubbed in thoroughly on and around each spot, after which the soldier will put his clothes on again and proceed with his duties. If clothing is heavily contaminated, it should be removed and replaced. It must be remembered that the use of protective ointment to decontaminate clothing is only a temporary measure. As soon as the tactical situation permits, the clothing will be changed.

[A. G. 300.7 (14 Sep 43).] (C 2, 20 Dec 43.)

BY ORDER OF THE SECRETARY OF WAR:

OFFICIAL:
J. A. ULIO,
Major General,
The Adjutant General.

G. C. MARSHALL,
Chief of Staff.

U. S. GOVERNMENT PRINTING OFFICE: 1943

BASIC FIELD MANUAL

DEFENSE AGAINST CHEMICAL ATTACK

CHANGES No. 3

WAR DEPARTMENT,
WASHINGTON 25, D. C., 28 April 1944.

FM 21–40, 7 September 1942, is changed as follows:

■ 7. CHEMICAL AGENTS.

* * * * *

e. Irritant smokes.

* * * * *

(2) *Diphenylchlorarsine* (*DA*).—Diphenylchlorarsine is a * * * than with DM. ***Caution:*** When irritant smokes (vomiting gases) are released in inclosed spaces concentrations may be so high as to cause serious symptoms and sometimes death.

f. Screening smokes.

* * * * *

(3) *White phosphorus* (WP).—White phosphorus is * * * effect upon personnel.

NOTE (Added).—*Precautions.*—Screening smokes consist of finely divided solid particles or liquid droplets suspended in the atmosphere. The suspended material may consist of metallic salts, metallic oxides, inorganic acids, hydrocarbons, and other materials. Any of these substances may be injurious if heavy concentrations are breathed for relatively long periods of time. Although the gas mask is not required for protection against ordinary smoke clouds, it should be worn in dense smoke to prevent inhaling large amounts of substances which may have irritating or injurious effects on the body. Therefore, if personnel must remain close downwind from smoke generators, gas masks should be worn to assure adequate protection. Since some individuals are more sensitive than others to these agents, gas masks should be worn if unpleasant effects are noticed. If screening smokes are released in inclosed spaces, heavy concentrations may result. Unmasked personnel must not enter such inclosures. When the enemy employs smoke, the gas mask must be worn to guard against possibility that toxic chemical agents may be dispersed along with the smoke. The mask may be removed when it is determined that the smoke does not conceal a toxic agent.

***These changes supersede section II, Training Circular No. 57, War Department, 1942.**

582350°—44

(4) *Precautions* (Added by C 1).—Rescinded.

g. Incendiary agents.—The purpose of * * * phosphorus, and oil. Appendix VI contains further information on incendiaries, together with methods of combatting them.

(1) *Thermit.*—(*a*) *General.*—Thermit is an * * * modification of thermit. It is a mixture of iron oxide, aluminum, barium nitrate, and small amounts of sulfur and castor oil.

(*b*) *Counteractive measures.*—Rescinded.

(2) *Magnesium.*—(*a*) *General.*—The German "Elektron" * * * of about 2,300° F. American magnesium bombs are described fully in **TM 9–1980.**

(*b*) *Counteractive measures.*—Rescinded.

(3) *White phosphorus.*

* * * * *

(*b*) *Counteractive measures.*—Rescinded.

(4) *Oil.*

* * * * *

(*b*) *Counteractive measures.*—Rescinded.

■ 9. General First-Aid Measures (As changed by C 1).

* * * * *

i. First aid for visicant casualties.

* * * * *

(2) *Breathing passages and digestive system* (Superseded).—First aid cannot cope with the effect of visicants (blister gases) on the breathing passages and digestive system. Speed is essential in removing vesicant liquid (especially mustard gas) from areas about the face to prevent inhaling vapors arising from the liquid. Care must also be exercised against vapors from contaminated clothing or personal equipment. The victim should be handled similarly to a lung irritant (choking gas) casualty. If medical aid is not available and evacuation is not possible for 24 hours or longer, "wound tablets" from the first aid pouch should be taken according to directions, to prevent pneumonia.

* * * * *

■ 110. Rules for Care and Use.

* * * * *

c. Rules for the individual.

* * * * *

(6) (Added.) Do not remove the mask in a gas concentration because a slight odor of gas is detected in the facepiece. If the facepiece is properly fitted and the mask in good condition, slight odors of gas in the facepiece should cause no alarm. In case the odor persists or becomes stronger, report to your gas noncommissioned officer as soon as the tactical situation permits.

Appendix VI (Added)

COMBATTING INCENDIARIES

Section I

GENERAL

■ 1. Characteristics and Control of Common Incendiary Agents.—The common incendiaries are phosphorus, oil, thermit, and magnesium. Combinations of these are also used (par. 7*g*). Each type is easily recognized. All are ordinarily controlled by use of water.

a. Phosphorus.—White phosphorus burns with a bright yellow flame, giving off white smoke. Phosphorus is easily controlled by flooding with water, but as soon as the water evaporates, it reignites. As phosphorus on the skin causes a severe burn, fragments should not be touched with bare hands.

b. Oil.—Oils, kerosene, benzine, and rubber burn with a yellowish flame and give off dense, black smoke. The oil fire should be attacked with suitable fire extinguishers (par. 7*c*, app. VI) or smothered with a blanket, dirt, or sand. Water is used to fight fires started by oil fires, but should not be used directly on oil.

c. Thermit.—Thermit burns with an orange glow and gives off intense heat. It is an igniter used in magnesium bombs. It is also used in large thermit incendiaries which are virtually uncontrollable, being violent but of short duration. Efforts should be directed toward control of the resulting fires.

d. Magnesium.—(1) *Characteristics.*—Magnesium burns with an intense, white glow and emits a white smoke. Water on magnesium makes it burn faster, but a small magnesium bomb can be extinguished by dropping it into a pail of water.

(2) *Methods of control.*—(*a*) A jet of water shot directly upon a magnesium bomb causes scattering and rapid burning. This is a quick method used where scattering of the metal is of no importance. The fragments can be quickly extinguished with the jet.

(*b*) Where much readily flammable material is nearby, use a coarse spray.

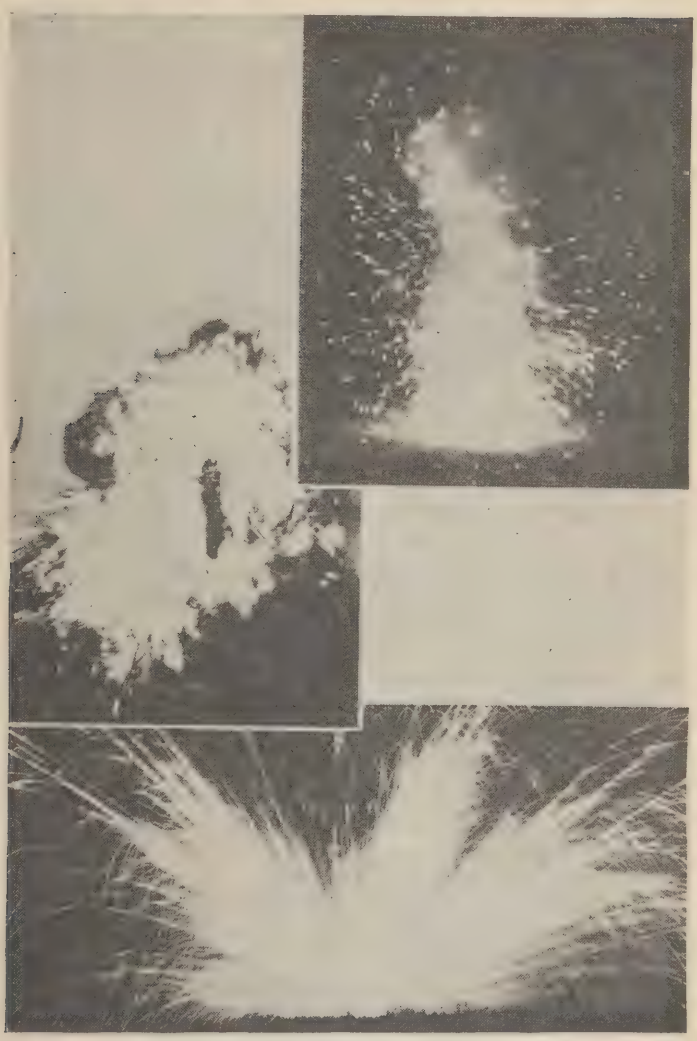


FIGURE 132.—Types of incendiaries.

■ 2. METHODS OF INCENDIARY ATTACK.—Incendiaries usually are—

a. Dropped in bombs from airplanes. (See FM 9–40 and TM 9–1980.)

b. Hurled by weapons and hand.

c. Installed manually.

■ 3. STRATEGY AND TACTICS.—Incendiary bombs may cause more destruction than any other aerial munition. Incendiaries may cause huge fires and heavy loss of life and property. The incendiary bomb is considered a strategic rather than a tactical weapon, and it has been used mainly against rear-area installations, yet its tactical targets include ammunition dumps, advance depots, railheads, airdromes, and supply columns. Incendiary shell, grenades, and flame throwers are primarily tactical.

a. Types of attack.—(1) Large incendiary bombs normally are used only on important installations (point targets), such as airdromes, railheads, docks, depots, and factories.

(2) Small incendiary bombs are customarily dropped in clusters against area targets. These bombs disperse in falling, the object being to start a number of separate fires which merge into a major conflagration. Bombing is coordinated in order to lay bombs in the most effective pattern.

b. Secondary missions.—(1) Explosive incendiary bombs often are included in incendiary bomb clusters. Besides starting fires, they impede incendiary defense.

(2) Fires started may light the way for high-explosive, precision bombing.

■ 4. FACTORS FAVORING INCENDIARIES.—*a. Targets.*

(1) Combustible roofs and wooden buildings.

(2) Combustible supplies in storage.

(3) Areas congested with buildings.

(4) Dry grass, ripe grain, and woods.

b. Conditions.—(1) Dry weather.

(2) High wind.

(3) Poorly trained and equipped defense organizations.

(4) Inadequate water supply.

■ 5. MEANS OF DEFENSE.—Defense against incendiaries, while fundamentally passive, must be aggressively conducted.

a. Precautionary measures.—Inspections should be made to insure that—

(1) Flammable materials are kept in nonflammable containers.

(2) Waste materials are not allowed to accumulate.

(3) Wooden surfaces, where practicable, are coated with whitewash, water glass solution, or other fire-resistant material (properly camouflaged).

(4) Materials for fighting incendiaries are readily accessible.

(5) A practical incendiary spotting and alarm system is in operation.

(6) Combustible supplies are dispersed.

(7) Ingenuity is employed in improvising supplementary equipment.

b. Incendiary defense organization.—(1) To combat incendiaries successfully, a unit defense organization should be established and taught to use available equipment.

(2) Periodic defense drills should be held. Anti-incendiary discipline of the entire unit should be stressed.

(3) Handling of small incendiaries is a technique that the individual soldier can be taught, just as he is taught the technique of individual gas protection.

(4) A fire guard for first-line defense should be established, consisting of individual fire guards equipped with and trained to use simple fire-extinguishing equipment.

(5) If civilian communities with organized fire-fighting services are near, liaison should be maintained in order to obtain aid for control of fires.

SECTION II

PROTECTIVE MEASURES

■ 6. GENERAL.—Plans for defense against incendiary attack cannot be as detailed when operating in the field as when in garrison. Much fire-fighting equipment ordinarily at hand in a permanent installation will not be available. Nevertheless, the same basic principles apply.

■ 7. EQUIPMENT FOR DEFENSE.—*a. General.*—In the field, incendiaries and the fires that they start must be controlled with

equipment on hand for fighting ordinary fires and with improvised equipment. This includes water buckets and barrels, sand and sand mats, garden and fire hose, burlap bags, axes, shovels, flashlights, rope, goggles, and gloves. Pump tanks, 3-gallon or 400-gallon decontaminating apparatus, and soda-acid or carbon dioxide extinguishers may also be available. Fire-fighting equipment must be kept in convenient, readily accessible places known to all.

b. Hose. -Prompt flooding with a stream of water from a hose will soon extinguish or control most small incendiary bombs of any type.

c. Fire extinguishers. Most fire extinguishers can be used. Their chief disadvantage is small capacity. Use of the carbon tetrachloride extinguisher is not advisable in confined spaces because of the possible generation of toxic fumes. Soda-acid and water types should not be used directly on oil.

d. Water barrels and buckets.—Barrels (kept full of water) and buckets should always be available. In freezing weather, salt should be added to the water in outdoor barrels.

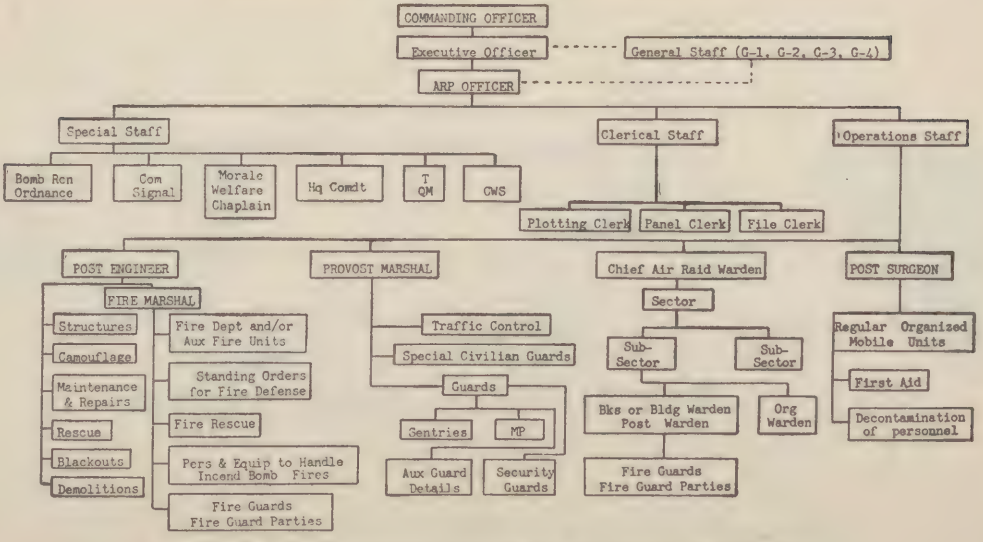
e. Sand.—Even if there is no lack of other equipment, sandbags should be conveniently placed, and containers of dry sand should be available for smothering effect. Twenty-pound sandbags are best for quick and easy handling. Twenty-pound bags, 15 by 12 by 3 inches, are known as sand mats.

f. Other equipment.—Pump tanks, knapsack type pumps, or the 3-gallon decontaminating apparatus are useful when fire or garden hose is not available. Shovels may be used to scoop up bombs or their molten particles for removal to places of safety. The 400-gallon decontaminating apparatus is excellent for fighting fires.

■ 8. Organization for Defense.—*a. Existing organization.*—The organization against air attack, existing at every military installation, must provide for incendiary defense.

b. Fire department cooperation.—A single small incendiary may cause an appliance fire—one which cannot be brought under control by a fire-fighting squad, but must be attacked with professional fire-fighting apparatus. In a theater of operations, large appliance fires are handled by Army engineer fire-appliance troops. In the United States, civilian fire-fighting organizations or civilian employees of the Army must handle these larger fires.

FIGURE 133. (Added.)



Essential air raid protection organization for military establishments.

c. General plans.—While no detailed plan will cover all situations, the following are important points in setting up a defense plan:

(1) Assign fire guard duty in addition to regular duty. Station fire guards at point targets or important installations and use them as patrols in important areas. The number and location of fire guards will depend on study of the susceptibility of particular areas to incendiary attack.

(2) Improvise additional equipment.

(3) Keep an inventory of locations of all materials and equipment useful in fighting incendiary bombs. This record is maintained at the control center where fire-fighting activities are coordinated.

(4) Keep fire-fighting supplies and equipment near all vital centers.

(5) A military area should be divided into sectors, with an officer responsible for the organization and its functioning in each sector.

(6) An air raid protection organization should be set up. The accompanying chart, "Essential Air Raid Protection Organization for Military Establishments," will serve as a guide.

d. Training.—All personnel should be trained to use available equipment and taught to recognize various types of incendiaries and their characteristics.

e. Advance planning.—(1) *General.*—Advance planning, with complete understanding of the plan by all responsible officers, is essential. Surveys should be made and a standing operating procedure should be established. Simplicity of plan is of prime importance.

(2) *Classification of areas.*—As part of the advance planning, areas should be classified according to—

(*a*) Type of construction.

(*b*) Amount of roof coverage.

(*c*) Tactical importance.

■ 9. METHODS OF COMBATTING INCENDIARIES IN IMPORTANT STRUCTURES.—*a. General.*—When an incendiary falls into an important building or area, such as an oil or ammunition depot, an attempt must be made to control the fire in spite of the risk involved. This also is true in the case of any structure the burning of which might cause a critical fire.

b. Precautionary measures.—A fire caused by an incendiary bomb is not different from a fire due to any other cause. It is only when dealing with the bomb itself that special precautions are necessary. A percentage of incendiary bombs normally contains high explosives, which usually detonate within 7 minutes after impact. Unless known to the contrary, all incendiary bombs must be considered to be of explosive type and treated accordingly. Ordinary room walls, tables, chairs, and similar objects do not provide a safe shield for a hose operator fighting such bombs. A brick wall 4½ inches thick offers adequate protection; whenever the shelter afforded by such walls is available, it should be used when combatting incendiaries. Only one fire fighter should risk exposure in an attempt to extinguish a bomb; do not risk additional casualties. When cover is available, no part of the fire fighter's body should be exposed except the hands. Helmets will be worn. When cover is not available, fire fighters operate from a nearly prone position and from a distance as great as equipment permits.

c. Employment of equipment.—(1) If the incendiary bomb falls close enough to be handled immediately, it may be scooped up with a long-handled shovel and thrown to a less combustible place.

(2) If this is not possible, the bomb may be smothered with one or two sand mats (par. 7*e*, app. VI). The fighters should then take cover, or run for a distance of 20 yards and lie flat. If no detonation occurs within 8 minutes, it can be assumed that the incendiary contains no explosive. Sandbags or sand mats reduce the fragmentation effect of explosive incendiary bombs. Some fragments are confined, and those which do escape have substantially reduced speed.

(3) Whether sandbags or sand mats are placed on the bombs, those falling in vital structures should be attacked at once with water from hose, pump tanks, knapsack type pumps, or the 3-gallon decontaminating apparatus operated from behind cover or from a prone position at maximum range.

(4) Fire extinguishers, if available, should be employed in the same manner as hose or pump tanks, with due regard for their limitations. The soda-acid extinguisher, like all other jet type extinguishers, tends to spread burning oil, but can be used to control fires adjacent to the burning oil. The carbon

FIGURE 134.—Use available cover when fighting small incendiary bombs. Such bombs always must be considered explosive. Brick walls offer excellent protection.

Use of protective equipment—

Controlling with sand mats—

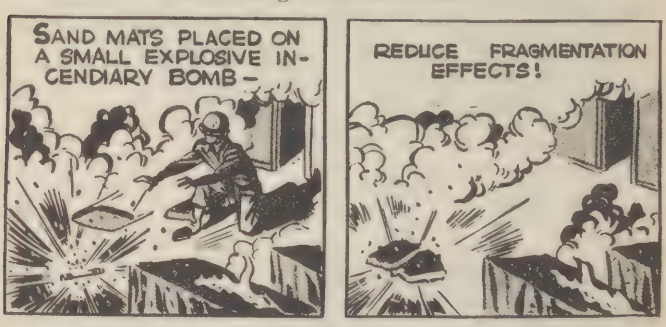


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FIGURE 135.

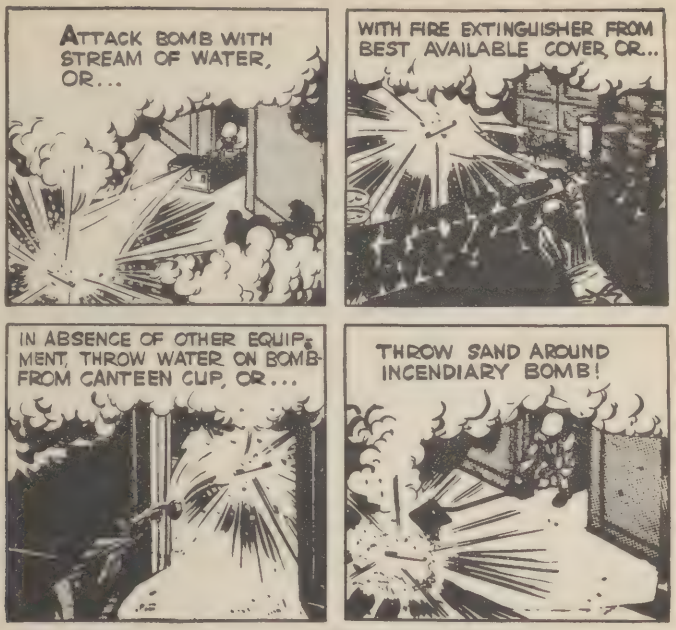

FIGURE 135.

tetrachloride extinguisher has limited use against incendiary bombs and should not be used in closed places.

(5) If water barrels and buckets are the only available equipment for putting water on the blaze, it is best to use a can or canteen cup to dip about a pint of water at a time from a bucket and throw it on and around the bomb. Utilize the best cover available. Throwing larger quantities is likely to cause an explosion. (A stream of water thrown on a bomb likewise causes an explosion, but the jet forces the flaming particles away from the fighter.)

(6) If other equipment is not available, sand may be thrown on the area adjacent to the bomb. This tends to smother fires started by the bomb. Sometimes it may be necessary to cover the bomb with sand and scoop up the bomb or its molten particles with a shovel. In such a case the bomb or particles may

be placed in a bucket into which a layer of sand has previously been put. The bomb is then covered with sand and carried to a safe point.

(7) The 400-gallon decontaminating apparatus may be employed in much the same manner as regular fire-fighting equipment if trained operators are available.

■ 10. INSPECTION AFTER INCENDIARY ATTACKS.—*a. General.*—After an incendiary attack, maintain a watch for several hours to make certain that fire does not again break out.

b. Phosphorus or oil.—When phosphorus or oil bombs have been used and the filling is spattered on walls and floors of buildings, the liquid must be kept wet and scraped away with a hoe, scraper, or knife. Then, as the surfaces dry, they must be watched for reignition of remaining incendiary.

c. Unexploded bombs.—After each incendiary attack, a careful inspection must be made for bombs which have not detonated, and for separated explosive portions which have not exploded.

(1) When such missiles have been located, the spot should be marked with a sign, "Unexploded Bomb," the area roped off, and personnel excluded. Under no circumstances will untrained personnel handle these "duds."

(2) Combustible materials should be removed from the immediate vicinity to prevent their ignition in case the bomb explodes.

(3) Bomb disposal is a function of the Ordnance Department. Bomb-disposal crews should be notified through channels.

d. Equipment.—Immediately after a fire has been extinguished all fire-fighting equipment should be inspected, restored to working condition, and returned to its usual place.

[A. G. 300.7 (19 Feb 44).]

BY ORDER OF THE SECRETARY OF WAR:

OFFICIAL:
J. A. ULIO,
Major General,
The Adjutant General.

G. C. MARSHALL,
Chief of Staff.

DISTRIBUTION:

As prescribed in paragraph 9*a*. FM 21–6; B and H (5); R (10); Bn (5); Bn 1 (10); C 10.

For explanation of symbols see FM 21–6.

U. S. GOVERNMENT PRINTING OFFICE: 1944

BASIC FIELD MANUAL

DEFENSE AGAINST CHEMICAL ATTACK

CHANGES No. 4

WAR DEPARTMENT,
WASHINGTON 25, D. C., 15 September 1944.

FM 21-40, 7 September 1942, is changed as follows:

Terminology of chemical agents is changed as follows. These terms should be corrected wherever they occur throughout the manual.

New terminology	*Old terminology*
Chemical agents:	
War gases:	
Casualty gases:	
Blister gases	Vesicants
Choking gases	Lung irritants
Blood and nerve poisons	Systemic poisons
Harassing gases:	
Vomiting gases	Irritant smokes or sternutators
Tear gases	Lacrimators
Screening smokes	
Incendiaries	

■ 5. DEFINITIONS (Superseded).—*a. Chemical agents* are substances used in war which, through their chemical properties, produce—

Injurious or irritant effect on personnel.
Screening smoke.
Incendiary action.

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*These changes supersede section III Training Circular No. 67, War Department, 1943; information on nitrogen mustards and titanium tetrachloride as added by C1 to table on "Vesicants."

b. War gas is a chemical agent which has an injurious effect on the body, or which harasses personnel.

NOTE.—The first chemical agents were literally gases—that is, they were in a gaseous state; hence the origin of terms such as "gas mask." These terms were short and convenient, so they continued in use even after introduction of such chemical agents as mustard gas (which is liquid at ordinary temperatures) and irritant smokes (which are finely divided solid particles). To the chemist, "war gas" is a misnomer if applied to mustard gas, and "liquid blister gas" is a contradiction in terms. But in its war application, "war gas" (or even "gas") is a specialized military term, sanctioned by long use. It is so used in this and other War Department publications.

c. Chemical warfare symbols are letters or combinations of letters and numerals designated by the War Department for convenience, to be used in place of full names of chemical agents. Some symbols have been changed recently in the interest of uniformity. Only current symbols are used in these changes.

d. Concentration refers to the amount of a war gas or screening smoke in a unit volume of air. It is usually expressed in ounces of substance per 1,000 cubic feet of air (numerically the same as milligrams per liter).

e. Hydrolysis is the reaction of any chemical substance with water to form new substances. This reaction is important in chemical warfare because—

(1) Many war gases are thereby rendered harmless. (But if the product of hydrolysis is itself a poison, as with gases containing arsenic, further effort is required to make the product harmless.)

(2) Some screening smokes depend to a considerable extent on hydrolysis for their obscuring effect.

f. Contamination is the process of spreading an injurious war gas. Personnel, objects, or terrain may be contaminated.

g. Decontamination is the process of removing or destroying chemical agents, or of changing them into harmless substances. *Only persistent gases need be decontaminated, and, generally speaking, only blister gases are persistent.*

■ 6. (Superseded) CLASSIFICATION OF CHEMICAL AGENTS.—Chemical agents are classified in four ways:

a. By physical state.

Solid	Liquid	Gas

NOTE.—This classification is based on the state of the substance under field conditions in temperate weather.

b. By tactical use.

Casualty gases—	Harassing gases—	Screening smokes—	Incendiaries—
Are capable of producing serious injury or death in ordinary field concentrations.	Force masking and slow operations. Only those which produce this result with a small quantity of munition are considered primarily as harassing gases.	When burned, hydrolyzed, or atomized, produce a dense, obscuring smoke, used to deny hostile observation and reduce effectiveness of enemy's aimed fire.	Are used primarily for setting fire to matériel. They may produce casualties from burns.

NOTE.—Many chemical agents have more than one tactical use. The most important use determines the primary classification.

c. By effect on body.

Blister gases (sometimes called *vesicants*) are readily absorbed by both exterior and interior parts of body, causing inflammation, blisters, and general destruction of tissue. Blister gas vapors attack respiratory tract much as choking gases do, although effects are usually more severe in upper tract. Eyes are very susceptible.	*Choking gases* (sometimes called *lung irritants*) cause irritation and inflammation of bronchial tubes and lungs. Their primary physiological action is limited to respiratory tract, injury extending to deepest part of lungs.

Blood and nerve poisons (sometimes called *systemic poisons*) cause injury after they are absorbed into blood stream.	*Vomiting gases* (sometimes called *irritant smokes* or *sternutators*) cause coughing, sneezing, pain in nose and throat, nasal discharge, and sometimes tears, often followed by headache.	*Tear gases* (sometimes called *lacrimators*) cause copious flow of tears and intense, although temporary eye pain.

NOTE.—The physiological classification omits screening smokes and incendiaries; however, white phosphorus (as an incendiary) and other incendiaries produce casualties.

d. By persistency.—"Persistency" means length of time a war gas normally remains effective in the open at point of dispersion. "Effective" means gas is capable of producing casualty or other intended effect on unprotected personnel.

Nonpersistent gases are those normally effective in the open, 10 minutes or less at the point of dispersion.	*Persistent gases* are those normally effective in the open at point of dispersion more than 10 minutes. Further division: *Moderately persistent* (10 minutes to 12 hours). *Highly persistent* (more than 12 hours).

NOTE.—Persistency usually decreases as rate of vaporization increases. Vaporization increases with heat, wind, and fineness of dispersion. Thus any given persistent gas is apt to be *less persistent* in hot weather, when exposed to wind, or when dispersed as fine spray. Even *nonpersistent* gases may persist for hours when collected in low, sheltered places and favored by cold, dampness, and still air.

■ 7. (As changed by C 1 and C 3) (Superseded) GENERAL DESCRIPTION OF CHEMICAL AGENTS.—*a. General.*—Descriptions given below are limited to features important in field identification. It should be noted that descriptions are of chemical agents developed by United States armed forces which are not necessarily identical with chemical agents the enemy may use.

b. Detection.—(1) *Odors* characteristic of chemical agents are likened below to generally known odors, but the individual may not always agree with these descriptions. Sensory reactions vary greatly; therefore, each man must learn *how each chemical agent smells to him.* Methods of training in identification, using the detonation gas identification set and the so-called "sniff set," are given in paragraph 8, and in TM 3–305.

(2) *Modification* of odors is to be expected in combat. Enemy counterparts of United States chemical agents may have odors which differ from ours, either because of manufacturing methods or intentional "masking" of odors. Intermingling battlefield odors also may distort characteristic odors; moreover, sensitivity to odors decreases with repeated exposure.

■ 7.1. DESCRIPTION OF BLISTER GASES (Added).—Blister gases are used for their casualty effect (or for the threat of casualties) by which normal use of ground may be denied, movements slowed, supply impeded, and use of matériel or installations prevented pending decontamination. Physiologically, they injure the eyes and lungs, and blister the skin. Troops should remember that enemy blister gases may not smell like ours and may even be odorless; therefore, detector devices provide the only reliable method of warning. Enemy gases also may differ from ours in persistency; for example, there are several varieties of nigrogen mustards which make it possible to deny normal use of ground for a long or short time, according to the enemy's plans. Blister gases include:

Physical state	Odor	Persistency
Mustard Gas (H)		
Normally dark brown liquid, changing slowly to colorless gas.	Like garlic or horseradish when impure; pure H may be nearly odorless.	High in winter; 20 days or more, since it vaporizes slowly. Less in summer; sometimes only 1 day. Solidifies below 45° F.
*Nitrogen Mustards (HN)**		
Some are liquid at normal temperatures; others are slow-melting solids. Colorless to pale yellow.	Faint to odorless; at strongest, like fish or soft soap.	Volatility (tendency to vaporize) varies greatly. Least volatile may persist for weeks, others as short a time as 1 hour.

*NOTE.—This is a "family" of war gases like H in some ways. HN's are chemically related to each other but differ in physical state, odor, persistency, and effect.

Physical state	Odor	Persistency
Lewisite (L) Colorless liquid when pure, but usually dark brown, oily liquid. Evaporates as colorless gas.	Odorless when pure; like geraniums when impure; always irritating to nose and throat.	Less than H, usually 1 to 7 days. Hydrolyzes in wet weather to lewisite oxide, a white solid which blisters skin after extended contact.
Ethyldichlorarsine (ED) Clear, somewhat oily liquid when pure, but usually brown liquid vaporizing as colorless gas. Slightly soluble in water.	"Fruity" and irritating.	Moderate; effective 1 to 12 hours, depending on weather, terrain, and concentration. Slow hydrolysis, forming poisonous product.
Methyldichlorarsine (MD) Colorless liquid, vaporizing as colorless gas.	Burning or irritating.	Same as ED (above).
Phenyldichlorarsine (PD) Clear liquid.	Irritating.	Same as ED (above).

■ 7.2. Description of Choking Gases (Added).—Choking gases injure unprotected men chiefly in the respiratory tract—that is, the nose, throat, and particularly the lungs. In extreme cases, membranes swell, lungs become filled with liquid, and

death results from lack of oxygen. The important choking gases are:

Physical state	Odor	Persistency
Phosgene (CG) Clear liquid at low temperatures; gas in warm weather unless under pressure. White mist when released, turning colorless.	Sweet in low concentrations; pungent (like freshly cut corn or new-mown hay) in high concentrations.	Nonpersistent; is dissipated on high terrain in 10 minutes or less.
Chlorpicrin (PS) Colorless, oily liquid. White gas when released, turning colorless.	Sweet, like flypaper.	Moderate, 1 to 12 hours.

■ 7.3. DESCRIPTION OF BLOOD AND NERVE POISONS (Added).—There are three principal gases in this category, namely:

Physical state	Odor	Persistency
Hydrocyanic Acid Clear, colorless liquid, changing to colorless gas.	Faint, undetectable to some; like peach kernels or bitter almonds.	Nonpersistent; lighter than air but cooled by rapid vaporization and thus temporarily and locally heavier than air.
Arsine Colorless gas.	Practically odorless when pure; otherwise garlic-like. (Metallic taste.)	Nonpersistent.
Cyanogen Chloride Colorless liquid, vaporizing on release to form colorless gas about twice as heavy as air.	Practically odorless; sometimes biting.	Nonpersistent.

■ 7.4. DESCRIPTION OF VOMITING GASES (Added).—Vomiting gases are normally solids, vaporizing when heated to form toxic smokes valuable for harassing; when released indoors they may cause serious illness or death. Principal vomiting gases are:

Physical state	Odor	Persistency
Diphenylaminechlorarsine (Adamsite) (DM) Yellow or green crystal solid in pure state, vaporizing when heated into yellow smoke.	Practically odorless.	Nonpersistent; lasts about 5 minutes at point of release.
Diphenylchlorarsine (DA) White solid in pure state, vaporizing under heat into fine white smoke.	Practically odorless.	Nonpersistent; lasts less than 10 minutes at point of release.
Diphenylcyanarsine (DC) Colorless, crystal solid, vaporizing under heat into white smoke.	Resembles garlic and bitter almonds.	Same as DA (above).

■ 7.5. DESCRIPTION OF TEAR GASES (Added).—Tear gases are used for harassing purposes, producing tears, and irritating the skin. Principal tear gases are:

Physical state	Odor	Persistency
Chloracetophenone (CN) Solid, converted by heat into colorless gas.	Like apple blossoms.	Persistent as solid; nonpersistent as gas.

Physical state	Odor	Persistency
Chloracetophenone Solution (CNS) Solid CN dissolved in mixture of chloroform and chlorpicrin. White gas when released, becoming colorless.	Same as CN (above).	Summer: Up to 1 hour in open, 2 hours in woods. Winter: Up to 6 hours in open and 1 week in woods.
Brombenzylcyanide (BBC) Brown, oily liquid, evaporating into gas.	Like sour fruit.	Summer: Up to 3 days in open and 7 days in woods. Winter: Up to 20 days.

■ 7.6. DESCRIPTION OF SCREENING SMOKES (Added).—Screening smokes are used both defensively and offensively. Smoke consists either of finely divided solid particles or liquid droplets suspended in the atmosphere. Smoke is injurious if heavy concentrations are breathed a relatively long time. Therefore, the soldier wears a gas mask in smoke when:

—He feels unpleasant effects (some men are more sensitive to smoke than others).

—Close downwind from source of smoke.

—Smoke is released indoors.

Smoke is used to camouflage war gases; therefore the soldier wears his mask whenever the enemy uses smoke, until it is determined that the smoke does not conceal a war gas. Principal screening smokes are:

Physical state	Miscellaneous
Sulfur Trioxide—Chlorsulfonic Acid Solution (FS) Liquid, hydrolyzing rapidly in air to form dense white smoke cloud.	Generally used for airplane spray. Corrodes metal and injures fabrics.

Physical state	Miscellaneous
Titanium Tetrachloride (FM)	
Colorless liquid atomized by spray or detonation to form white smoke.	Obscuring power slightly less than FS. Used in same way as FS.
Hexachlorethane Mixture (HC)	
Solid; produces dense white smoke when burned.	Used in smoke pots: high obscuring power. Service gas mask carrier may break down under prolonged use in HC smoke; self-contained oxygen mask necessary.
White Phosphorus (WP)	
White or amber solid, igniting spontaneously on exposure to air, making dense white smoke.	Most effective screening smoke; secondary use as incendiary and war gas.

Special Oil
This is used in mechanical smoke generators. In one model, steam is shot into cold oil; the two are superheated, then ejected to become a thick fog upon contact with atmosphere. In another model, water and oil are mixed before heating.

■ 7.7 DESCRIPTION OF INCENDIARIES (Added).—Incendiaries are used to ignite combustible material, but may also injure personnel. Combinations of incendiaries are sometimes used. American incendiary bombs are described in TM 9–1980, "Bombs for Aircraft." Common incendiaries are:
Thermit (TH)
Normally used as igniter in magnesium bombs; also in large thermit bombs which are virtually uncontrollable.

Physical properties	Burning	Control
Intimate mixture of iron oxide, aluminum, barium nitrate, and small amounts of sulfur and castor oil.	Aluminum reacts with iron oxide and generates high temperature (4,300° F.), producing molten iron. Burns with orange glow, quickly and violently.	Resulting fires should be combatted, not bomb itself.

Magnesium

Used for cases of small incendiary bombs; powder form used as ingredient of gel mixture for large incendiary bombs.

Physical properties	Burning	Control
Metallic (solid or powder).	Magnesium case in 4-pound bomb burns 10 to 15 minutes at about 3,600° F. Has intense white glow and emits white harmless smoke.	Burns faster when water is used, but explodes when jet of water is applied; resulting fragments are quickly extinguished. Small bombs best extinguished by dropping in pail of water.

White Phosphorus (WP)

Unsatisfactory incendiary because of low burning temperature, but ignites readily flammable materials, especially dry vegetation; often used in so-called "calling cards" dropped on forests, etc. Effective against personnel, causing painful burns; large fragments may kill.

Physical properties	Burning	Control
See paragraph 7.6.	Burns with bright yellow flame, giving off white smoke.	Stops burning when flooded with water, but reignites when water evaporates; copper sulphate solution stops burning of particles clinging to flesh.

Oil (SR, CR, LA)

Used extensively by Japanese. Little used by United States.

Physical properties	Burning	Control
Gasoline with coconut oil and rubber thickener. Small pieces of metallic sodium sometimes added to prevent easy extinguishing.	Has yellow flame; emits dense black smoke.	Should be attacked with any fire extinguisher or smothered with blankets, dirt, or sand. Water is used on resulting fires, but not directly on oil.

Gasoline Gels (NP, IM)

Used extensively by United States as filling for bombs, grenades, and flame throwers.

Physical properties	Burning	Control
Thickened gasoline, often looking like rubber cement.	Burns with yellow flame; produces a dense black smoke.	Smothering with earth best control. Water may also be used.

■ 9. (As changed by C1 and C3) (Superseded) FIRST AID FOR GAS CASUALTIES.—*a. General.*—Protective equipment reduces the hazard from field concentrations of war gases to a minimum. Effects of gases on unprotected personnel depend primarily on two factors:

(1) Concentration and time of exposure. (Long exposure to a weak vapor concentration usually has the same effect as short exposure to a heavy concentration.)

(2) Susceptibility of the individual. (Different soldiers show varying sensitivity to the same gas.)

b. Responsibility.—Personal decontamination is the individual soldier's responsibility. So is first aid. Decontamination promptly and properly performed prevents needless injury and enables men who would otherwise be casualties to perform their usual duties.

c. Disposition of exposed personnel.—Immediate disposition is a command decision. Considering the tactical situation, severity of exposure as known to him, and the medical officer's recommendation, the unit commander decides whether exposed personnel should be continued in action. The need for evacuation is often obviated in nonpersistent gas attacks if masks have been adjusted properly, since these gases are dissipated in a very short time.

■ 9.1. EQUIPMENT (Added).—*a. For individual protection,* the soldier has protective clothing, shoes treated with impregnite, gas mask, eyeshields, and protective covers. The gas mask provides ample protection against nonpersistent gas in normal field concentrations; other items are needed for protection against blister gases.

NOTE.—His mask is the soldier's best protection. It is always adjusted *first,* before administering first aid, unless the face and eyes are contaminated. Such contamination is always removed before masking, even in a contaminated area.

b. For individual first aid, the soldier is issued protective ointment and BAL eye ointment. In addition he may carry soap to wash contaminated skin and may use his first-aid kit to take care of incendiary burns.

c. For organizational first aid, the gas casualty first-aid kit is issued on the basis of 1 kit per 25 men, each kit containing an instruction sheet. Contents of the kit are:

Item 1. Chloroform, U. S. P.
Item 2. Calamine lotion with 1 percent phenol and 1 percent menthol.
Item 3. Copper sulfate, 10 percent solution.
Item 4. Eye and nose drops.
Item 5. Eye solution, BAL.
Item 6. Cotton pads.
Item 7. Amyl nitrite, U. S. P.
Item 8. BAL ointment (two tubes).
Item 9. Protective ointment.

■ 9.2. BLISTER GASES (Added).—*a. General.*—Blister gases, as a group, have many characteristics in common. These include—

(1) *Action.* Blister gases burn and blister any area of the body they contact, either in liquid or vapor form.

(2) *Effectiveness.* A drop the size of a pinhead produces a blister the size of a quarter. An unmasked man exposed 1 hour to a few parts of vapor per million parts of air can become a casualty. All blister gases have marked effect on the eyes.

(3) *Penetration of body.* Blister gases are absorbed by skin, as ink soaks into a blotter.

(4) *Insidious character.* H and HN can "creep up" without warning, since they sometimes have no odor and cause no immediate pain. No sign of injury may appear for 2 to 4 hours. (L usually irritates the skin, eyes, and respiratory tract immediately, however, and liquid L stings the skin within a minute or two.)

b. First-aid procedure.—(1) Eyes are given first attention before the mask is adjusted, even if the victim is still in a contaminated area. Contaminated portions of clothing (ordinary or protective) may be cut away, or garments removed entirely if grossly contaminated.

(2) Vapor burns to skin, eyes, or respiratory tract cannot be decontaminated successfully

(3) Liquid burns demand fast action; first aid is much less effective when applied after the first 2 or 3 minutes. Measures are taken in the following sequence:

Care for eyes.
Decontaminate hands.
Decontaminate face, neck, and ears.
Adjust gas mask.
Decontaminate other parts of body.
Take care of personal equipment.

Procedures for blister gases are outlined in the following chart:

Area affected	Mustard gas and nitrogen mustards	Lewisite and other arsenicals (Ethyldichlorarsine, Methyldichlorarsine, and Phenyldichlorarsine)
	Physiological Effects	*Physiological Effects*
E	*H:* Vapors cause no immediate symptoms; even liquids are only mildly irritating at first. In a few hours eyes become inflamed, smart, water, feel gritty, and are sensitive to light. Lids swell. In severe cases there is great pain, tears, and yellow discharge—permanent damage may result.	*L:* Eyes are especially susceptible. Vapor irritates immediately; liquid causes instant, excruciating pain and spasm of eyelids. Unless first-aid measures are taken immediately, eyes swell and inflame seriously within 1 hour, and may be permanently injured.
Y	*HN:* Generally the same as H, but damage from more volatile forms of HN is more severe.	*ED, MD, PD:* Same as lewisite, but generally less severe.
	First aid	*First aid*
E	Flush with water *immediately*. Flushing is very helpful if done in first minute after contamination, but valueless after 2 minutes. To flush, hold face upward, opening injured eye by pulling on lower lid with one hand, and pouring water from container held in other. Have patient move eye from side to side, and up and down. Continue washing for ½ to 2 minutes. If no water is available, use urine or Item 4 (eye and nose drops) from gas casualty first-aid kit.	Apply BAL eye ointment at once, either for liquid or vapors severe enough to cause pain and spasm of the lids. If lids can be opened, squeeze ointment directly into eye and massage lids gently; if not, apply to closed eye and rub into slit between lids. As soon as pain lessens and eye can be opened, apply more ointment. Also rub it on eyelashes, lids, and skin around the eye. If no BAL eye ointment is available, use BAL eye solution (Item 5 in gas casualty first aid kit). Open eye, place two to four drops in it, and one or two drops on eyelids. *Apply only once.* ***Caution:*** Do not use BAL eye ointment or solution unless eyes are painfully affected by arsenical blister gas; it causes temporary irritation, but is not injurious.
S		

Area affected	Mustard gas and nitrogen mustards	Lewisite and other arsenicals (Ethyldichlorarsine, Methyldichlorarsine, and Phenyldichlorarsine)
RESPIRATORY AND DIGESTIVE SYSTEMS	*Physiological effects* *Respiratory system.* Vapors inflame throat and windpipe if breathed. Mouth becomes dry, throat burns, and harsh, distressing cough develops. Partial loss of voice is common. Pneumonia may develop in severe cases. *Digestive system.* Nausea and vomiting may follow severe skin contamination, especially in hot weather, even if mask has been worn. This is a systemic effect not due to direct injury; swallowing of contaminated saliva, food, or drink may cause inflammation of stomach, pain, and vomiting.	*Physiological effects* *L:* Same as H. *ED, MD, PD:* Same as H, generally, but breathing very low vapor concentrations may cause coughing, sneezing, pain in nose and throat, nausea and vomiting, and distressed feeling.
	First aid Same for both respiratory and digestive tracts. Remove liquid gas from face immediately to prevent further inhalation of vapors. Also remove contaminated clothing. No other first aid is effective. Victim is handled like choking gas casualty: loosen clothes, keep quiet and warm, give warm (nonalcoholic) drink, and evacuate by litter. If no medical treatment is available and evacuation is impossible for 24 hours or longer, give wound tablet from first-aid pouch to prevent pneumonia.	*First aid* *L:* Same as H. *ED, MD, PD:* Generally the same for H, but after exposure to low vapor concentrations (producing symptoms like those of vomiting gas), rinse nose and throat with water, and keep patient quiet. Fumes of chloroform (Item 1 in gas casualty first-aid kit) may be inhaled to give relief in severe cases, inhalation being repeated as required.

S	*Physiological Effects* *H:* Injury begins with reddening, like sunburn, and may be followed by blistering (under different climatic conditions, this varies with concentration and length of exposure). *Liquid* always blisters unless counteracting steps are taken at once. Normally moist skin areas are most affected (like bend of elbows and knees, armpits, and crotch).	*Physiological Effects* Same as H, but liquid acts faster, penetrating skin rapidly and causing stinging sensation within 1 or 2 minutes; vapor far less dangerous than H vapors.
K	*HN:* Vapor about one-fifth as damaging as H. Liquid forms blisters more quickly, but they are less severe.	
I	*First Aid* *H:* Liquid must be removed and skin decontaminated within 3 minutes to avoid blistering. Remove contaminated clothing. Then blot skin with absorbent material furnished with protective ointment, or with dry cloth. Be careful not to contaminate additional skin while blotting. Next, squeeze protective ointment from tube, rubbing it on affected area about 15 seconds. Wipe off excess ointment.	*First Aid* Liquid is blotted from skin immediately. If skin hurts, gas may be assumed to be an arsenical. Apply protective ointment as described for H burns (although it may not completely prevent blistering if weather is hot). Use soap and water if nothing else is available. Attempt to prevent blisters from breaking; leave them for medical treatment. Vapor burns cannot be helped by first aid.
N	Repeat this procedure if skin has been heavily splashed. Soap and water can be used as a substitute, or bleach paste (equal quantities of water and dry bleach) can be used if washed off within 3 minutes.	NOTE.—When gas casualty first-aid kit is available, BAL eye ointment from the kit may be used on the skin. But the individual soldier's small tube of BAL eye ointment is used *only* for contaminated eyes.

Area affected	Mustard gas and nitrogen mustards	Lewisite and other arsenicals (Ethyldichlorarsine, Methyldichlorarsine, and Phenyldichlorarsine)
S K I N	*First Aid*—Continued Don't use either ointment or bleach if skin has already reddened or begun to blister; it only increases the burn. Instead, use calamine lotion (Item 2 in the gas casualty first-aid kit), following instructions given in kit. *Vapor* burns cannot be helped by first aid; the damage is already done, and neither ointment nor soap and water helps. *HN: Liquid* burns are treated with ointment in same manner as H liquid burns. But ointment merely dilutes and does not destroy HN. Therefore, wash off film of ointment with soap and water preferably, or with water alone. Don't use ointment if skin is already red; instead, use soap and water. *Vapor* burns cannot be helped by first aid, since damage is already done. NOTE. If blisters develop from either H or HN burns, try to prevent them from breaking until medical treatment is available.	M5 PROTECTIVE OINTMENT All references to protective ointment noted above apply to M4 ointment. M4 ointment will be replaced by M5 ointment, now in production. M5 ointment is used exactly as M4 ointment with these exceptions: (1) On applying M5 ointment to contaminated skin, rub it in for 30 seconds instead of 15 seconds. (2) Leave it on the skin. (3) M5 ointment is used *before* exposure to blister gas, as well as after. Using the entire contents of one tube, rub ointment in a smooth, even coating on unprotected skin areas. Apply again whenever absence of the characteristic color (gray green) indicates the skin is no longer protected. *Before-exposure protection extends only to blister gas vapor; if droplets fall on skin, decontamination must be accomplished as directed in above tables.*

■ 9.3. Choking Gases (Added).

Physiological effects	First aid
Symptoms vary considerably, but there is usually irritation of nose and throat, coughing, difficulty in breathing, and pain in chest, especially upon deep inhalation. Other possible symptoms are tears, vomiting, sweating, easy fatigue, and blueness of lips and ear lobes. Symptoms appear immediately only if exposure has been severe. They may persist and grow worse; but often first symptoms disappear, followed by latent period in which victim feels fairly well. More serious symptoms of lung injury may not appear for several hours.	Keep mask adjusted until area is free of gas. Soldier should carry on if there are no immediate symptoms. But if there *are* immediate symptoms, institute first aid as soon as tactically possible. Loosen clothing, have soldier rest, and keep him warm with blankets. Do *not* give artificial respiration. Offer nonalcoholic, stimulating drinks (hot tea or coffee). Evacuate to aid station by litter as soon as possible. Greatest danger for choking gas victims is during first 48 hours after exposure.

■ 9.4. Blood and Nerve Poisons (Added).

Physiological effects	First aid
Hydrocyanic acid or cyanogen chloride	
Highly toxic when inhaled. *High concentration* is fatal (labored breathing, convulsions, coma, then death). *Low concentration* may produce headache, dizziness, and nausea. First breath may so stimulate respiration that it is impossible to hold breath. *Liquid* penetrates the skin and is toxic.	*If victim is in a closed place*, mask him and move into fresh air immediately; too great a concentration may penetrate the gas mask canister. *If he has stopped breathing*, give artificial respiration until medical aid is available. Use amyl nitrite (Item 7 of gas casualty* first-aid kit) meanwhile. Crush and hold close to victim's nose or thrust inside facepiece if masked. Repeat at 3- to 5-minute intervals, meanwhile continuing artificial respiration. *If liquid gets on skin*, wash with water or a weak solution of baking soda and water. Remove clothes containing liquid, and let them air.
Arsine	
Mild cases cause lassitude, headache, and uneasiness. *Increased exposure* causes chills, nausea, and vomiting. *Severe exposure* damages blood, causing anemia; urine is brown or red.	Adjust mask and remove victim by litter to fresh air. Do not let him walk. Hospitalize immediately.

■ 9.5. Vomiting Gases (Added).

Physiological effects	First aid
Irritate nose and throat, often causing coughing, sneezing, and salivation. Pain in nose, throat, and windpipe is fairly intense; gums and teeth ache. Nausea and vomiting may occur, and victim may feel very distressed. But there is little danger, and effects usually pass within 3 hours. Most victims can carry on strenuous duties without harm, and often with a more rapid decrease in symptoms.	Keep mask adjusted as long as gas is present in atmosphere, removing it only briefly during periods of actual vomiting. Remove, shake, and air outer clothing if situation permits. Wash skin with soap and water. If symptoms persist, rinse nose and throat with water. In extreme cases, keep victim quiet until distressing symptoms have passed, and have him inhale fumes of chloroform (Item 1 in gas casualty first-aid kit). Repeat inhalations as required.

■ 9.6. Tear Gases (Added).

Physiological effects	First aid
Produce acute pain in eyes, profuse tears, and spasm of eyelids. There is usually no permanent damage, and effects wear off quickly; but temporarily victim may find it almost impossible to see.	Do not rub eyes; this only increases the irritation. Keep mask adjusted until atmosphere is free of gas, then remove it and face into wind with eyes open. Skin areas which sting or burn, or on which liquid gas has been splashed, should be washed with soap and water. If liquid has entered eyes, flush them with plenty of water, or use eye and nose drops (Item 4 in gas casualty first-aid kit). Medical treatment is not ordinarily needed, nor is evacuation normally necessary.

■ 9.7. Screening Smokes (Added).

Physiological effects	First aid
Liquid smokes	
Liquids irritate or burn skin. Smoke itself is usually harmless except in prolonged exposure; slightly irritating to respiratory tract.	Wash liquid from body with water (preferably soapy). If respiratory tract is irritated by smoke, move to fresh air when tactically possible.
Solid smoke (HC)	
Prolonged exposure without mask irritates nose and throat; may cause coughing and lung irritation.	Remove victim to fresh air if tactically possible.
White phosphorus	
Smoke is harmless except in prolonged exposure, but burning particles cause severe burns.	Immerse affected skin area in water to extinguish burning particles. Exclude air from particles until they can be removed; otherwise, they reignite. Try to wipe or brush particles from skin with wet cloth. (Medical aid may be required for this.) Apply copper sulfate (Item 3 in gas casualty first-aid kit) to burned area for several minutes. This coats particles, keeping them from air, and permits exposure of burn without danger of fire. Particles can then be removed more easily, preferably with forceps. ***Caution:*** Do not use grease, oils, or ointments; phosphorus poisoning may result.

■ 9.8. INCENDIARIES (Added).

Physiological effects	First aid
White phosphorus burns are discussed under screening smokes (par. 14). Other incendiaries cause ordinary burns.	If skin is broken, cover raw area with first-aid dressing. For more serious burns, give victim first aid for shock, keep quiet and warm, and evacuate as soon as possible.

■ 126. PERSONAL PROTECTIVE MEASURES (As changed by C 1).—*a. Protective ointments **M1, M2, M3, and M4.***—Protective ointments will * * * skin," are rescinded.

* * * * *

Appendix VII (Added)

PROTECTION AGAINST CHEMICAL SPRAY ATTACK

■ 1. General.—The following procedure for protection against chemical spray attack (based upon present knowledge as gained through tests) is fundamental, is intended only as a guide, and may vary according to local conditions. The procedure as modified locally will be made a part of the SOP for defense against air attack.

■ 2. Eyeshields.—Eyeshields will be worn at all times in the open when spray attack is likely.

■ 3. Warning of Airplane Spray Attack.—When attacking aircraft are actually observed to begin a *spray* attack, only the warning cry of "SPRAY!" will be given.

■ 4. Protective Cover.—For additional information see TM 3–290.

a. Procedure for use.—(1) Immediately put on protective cover on hearing the cry of "SPRAY!" and follow SOP for defense against air attack (if firing, thrust rifle or carbine forward through top corner of protective cover).

(2) While under the cover (worn for the brief period in which spray is falling and droplets are in the air), remove eyeshields, decontaminate face and hands, and adjust gas masks. Test for spray by means of detector paper before removing covers.

(3) After removing covers and as soon as the tactical situation permits, men inspect one another for evidence of contamination, and carry out further personal decontamination where necessary. Speed in personal decontamination is essential. Discard cover, and if possible destroy it, after exposure to a spray attack.

b. Procedure if contaminated.—Frequently, in surprise spray attack, there will not be time to adjust protective covers quickly

enough to avoid becoming contaminated. When this occurs, the following instructions will be observed:

(1) Do not attempt to adjust protective cover, but follow SOP for defense against air attack.

(2) When spray has ceased to fall, discard eyeshields.

(3) Carry out personal decontamination as soon as the tactical situation permits.

(4) Adjust gas mask if remaining in the sprayed area.

c. Caution.—(1) After a spray attack, care must be exercised in passing through contaminated vegetation.

(2) Personnel, after having their clothing sprayed even lightly, will avoid closed places for at least 4 hours, or until clothing is removed.

d. Specially designated personnel. The protective cover will not be used when it interferes with normal functions of an essential task of specially designated personnel.

[A. G. 300.5 (17 Feb 44).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION:

As prescribed in paragraph 9a, FM 21–6 except D (5); T of Opns (10); Island Cs (10); Base Cs (10); Def Cs (10); B (5); R (10); Bn (5) except Bn 1 (10); C (10).

For explanation of symbols, see FM 21–6.

U. S. GOVERNMENT PRINTING OFFICE: 1944

BASIC FIELD MANUAL

DEFENSE AGAINST CHEMICAL ATTACK

CHANGES No. 5

WAR DEPARTMENT
Washington 25, D. C., 1 May 1945

FM 21-40, 7 September 1942, is changed as follows:

■ 7.6. DESCRIPTION OF SCREENING SMOKES (As added by C 4).

* * * * *

Physical state	Miscellaneous
* * *	* * *
Hexachlorethane Mixture (HC)	
Solid; produces dense white smoke when burned.	Used in smoke pots: high obscuring power.
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■ 9.2. BLISTER GASES (As added by C 4).—*a. General.*

* * * * *

b. First-aid procedure.

* * * * *

(3) Liquid burns demand * * * the following chart:

***These changes supersede section IV, Circular No. 237, War Department, 1944; section I, Circular No. 325, War Department, 1943; and section VI, Circular No. 95, War Department, 1943.**

AGO 16D—May 637204°—45

Area affected	Mustard gas and nitrogen mustards	Lewisite and other arsenicals (Ethyldichlorarsine, Methyldichlorarsine, and Phenyldichlorarsine)
EYES	*Physiological effects* * * *	*Physiological effects* * * *
	First aid (Superseded) *a. Procedure:* Immediately after the eye has been contaminated by a liquid blister gas, do the following: (1) Squeeze BAL eye ointment directly into the lower part of the eye and massage the eye for 1 minute. (2) Irrigate the eye with water from a canteen or other available uncontaminated source, pouring the water directly and slowly into the eye *for at least 30 seconds*, or until the canteen is empty; but not for longer than 2 minutes. If BAL eye ointment is not immediately available, the eye should be irrigated as early as possible without waiting to obtain the ointment. *b. Discussion:* The treatment must be completed before the gas mask is put on, in spite of the presence of vapor. Therefore, the individual should hold his breath as much as possible. BAL eye ointment placed in an uncontaminated eye is quite irritating and causes immediate stinging and blinking which may interfere with the individual's combat ability for a period up to 15 minutes. Therefore, BAL eye ointment should be used in the eye only when the individual is fairly certain that his eye has been contaminated by liquid blister gas. The chance of liquid contamination is slight except when in close vicinity of a shell or bomb burst or in a direct airplane spray. Liquid mustard in the eye causes no immediate pain or discomfort. When BAL eye ointment is placed into an eye contaminated with liquid mustard there will be immediate irritation and blinking. *This is to be expected and treatment should not be discontinued because of it.* The irritation from the ointment stops as soon as the irrigation with water is begun. However, the irrigation should not be stopped as soon as the stinging disappears, but should be continued for the length of time outlined earlier in this paragraph. When liquid lewisite is the contaminating agent, the immediate pain and blinking caused by the agent is rapidly relieved by the use of BAL eye ointment. The blinking may be so uncontrolled as to preclude the immediate placement of ointment into the lower part of the eye. In such cases the ointment may be put on the outer lids and massaged well, thus working some of the ointment between the lids into the eye. This will relieve the pain and blinking to such an extent as to permit the direct placement of the ointment into the lower part of the eye. In contaminations by liquid mustard, the initiation of treatment within the first few seconds is markedly effective, but after 2 minutes is of very little value. In the case of lewisite contamination, BAL eye ointment is effective for a longer period of time. If it is used within 1 minute after the contamination, the eye usually recovers in a few days.	

■ 34.1. VOICE TRANSMISSION PROPERTIES OF GAS MASKS. (Added.)—*a. Combat service mask of lightweight service mask* can be worn without impairing accuracy of voice transmission over field radios and telephones. Volume of reception, however, is reduced when sender is wearing a gas mask. Satisfactory transmission results if the following precautions are observed by the wearer:

(1) Hold radio transmitter in direct contact with outlet valve unless blurring results, in which case, hold transmitter

about 3 inches away from and directly in front of outlet valve.

(2) Hold telephone transmitter in direct contact with outlet valve unless blurring results, in which case, hold transmitter above and to the left of outlet valve against lower part of left eyepiece.

b. Service gas mask or diaphragm mask, when worn, affects the audibility of telephone or radio conversations. This is partially overcome by holding transmitter of radio or telephone directly in front of and close to diaphragm of diaphragm mask, or outlet valve of service mask, while talking. Holding transmitter in this position may cause receiver to be moved from the ear. Consequently, the person at the other end of the line must be prevented from talking when he cannot be heard by the person wearing the mask. The person not wearing a mask should be informed that a gas mask is being worn by the other party and that the word "over" will be used each time he has finished talking to indicate that he is prepared to listen.

■ 47. GAS OFFICERS, GROUND AND SERVICE FORCES.—*a.* Each regiment and battalion will have at all times a minimum of one unit gas officer and one gas noncommissioned officer who are qualified instructors, and each company, including separate companies, will have a minimum of one unit gas officer and two gas noncommissioned officers. These officers and * * * officer will overlap.

* * * * *

d. Following is a list of the more important duties of regimental, battalion, and company gas officers:

(1) *General duties.*

* * * * *

(*q*) (Superseded.) Supervision of the training of a squad per company in decontamination methods.

* * * * *

■ 49. POST CHEMICAL OFFICER.—*a.* The post chemical * * * ammunition are concerned. Commanders of nondivisional units and commands (including replacement training centers) in which a unit or staff chemical officer is not available may request and receive the assistance of post chemical officers in the training of their units or commands in defense against chemical attack. Tactical units, such * * * this tactical unit.

* * * * *

f. Rescinded.

* * * * *

■ 85. INSPECTION PROCEDURES.—***a. General.***—Each individual is * * * should be corrected. Inspections should be made not only for faulty equipment but also as a check on training efficiency and gas discipline of personnel. Before going into * * * the unit commander.

b. Inspection of hose connections. (Added.) Gas masks equipped with hose tubes should be inspected weekly, when in service, to ascertain that the hose tube connections at the facepieces and canisters are firm and gastight. Inspections should be made under direct supervision of the company commander. Examination of synthetic rubber hose tube connections should be especially thorough. Tests should be performed by vigorous hand twisting of the connections, followed by hand pulling, donning facepiece, inhaling to collapse facepiece for a period of 10 seconds, and noting that leakage is absent. No leakage should be permitted. If leakage is found at hose tube connections, leaking masks should be rehabilitated by renewing wire bindings, as provided in TM 3-205. Similar tests should be made when each mask is newly issued.

■ 106. FITTING. **Instruction in proper fitting, slinging, and adjustment of gas masks is a command responsibility. Commanding officers should take such measures as are necessary to insure adequate instruction in the correct fitting, sling, and adjustment of the mask for all individuals within their commands. This responsibility cannot be delegated to noncommissioned officers. Therefore, when gas masks are issued it is necessary that: (1) each individual be properly fitted as to face size; (2) provision be made for the necessary training in the correct methods of slinging the mask in its various positions, including removing and replacing the mask in the carrier (C 1) and the proper use of the pockets of the carrier; and (3) instructions are given in the adjustment of the mask. (See C 1.)**

a. Facepiece. (Superseded.) Facepieces must fit wearer to secure a comfortable, gastight seal. Slight dimensional variations may occur among facepiece molds of one manufacturer, or among the molds of different manufacturers. These variations may mean the difference between a comfortable gastight fit and an improper, uncomfortable fit. Due to variations in manufacturing processes, the universal facepiece comes in three

sizes: SU (small universal), U (universal), LU (large universal). The universal size, with the variations SU and LU, affords a good serviceable fit and ample protection in approximately 95 percent of the cases. Faces which are too large to be satisfactorily fitted with the universal size (U) should be fitted with an L or LU size; faces which are too small should be fitted with an S or SU size. No effort should be made to *make* the universal size (U) fit by making straps too tight.

NOTE.—Some gas mask facepieces (diaphragm, universal service, and small size service) marked "Acushnet" or "APC" have been found to exert temple pressure and cannot be worn comfortably by some personnel. The same condition may, however, be observed with facepieces with other markings. Any facepiece which does not fit properly should be disinfected for subsequent issue and other facepieces tried on until a good fit is obtained. Facepieces with markings as described below have been found to exert temple pressure and cannot be worn comfortably by some personnel.

(1) *Lozenge type marking.* Reading from top to bottom: Lot ———; "Acushnet" in script, surrounded by an ellipse; M ———; and a date marking of 4 42 or higher.

(2) *Medallion type marking.* Consists of two or three concentric circles. In the inner circle, reading from top to bottom, are: 43/APC M ———. From 1 to 28 dots are included between the outer circles.

(3) *Combination marking.* Consists of a modified lozenge type marking with the word "Acushnet" in script on one side of the outer chin section, and on the opposite section, dots on the periphery of a circle surrounding the numeral 43.

b. Fitting.

* * * * *

■ 106.1 NOSECUP. (Added.)—*a. General.*—Facepiece of the lightweight service mask is equipped with a rubber nosecup (fig. 90.1) which prevents exhaled air from coming in contact with the lenses, thus lessening the tendency of the lens to fog or frost. (See TM 3-205.)

b. Adjustment.—It may be found that the nosecup presses on the bridge of the nose causing discomfort. Substitution of another mask with faceblank made by a different manufacturer may overcome this condition. If substitution does not solve the difficulty, nosecup may be altered under supervision of a gas officer. Rubber material of nosecup is trimmed away, or slit where it rests on bridge of nose. Before making a slit in the nosecup, reinforce it by cementing a piece of patching fabric from the company gas mask repair kit MII in such a position

that the slit can be made in the area thus reinforced. This prevents further tearing.

Figure 90.1 (Added.)—Gas mask facepiece showing nosecup.

■ 107. GAS CHAMBER TEST FOR FITTING.

* * * * *

c. Gas chamber exercise.

* * * * *

(1) *Phase I.*—(a) Fill the gas * * * gas (chloracetophenone, CN). For every 1,000 cubic feet of space in the chamber

use one CN capsule. (Place the capsule * * * mask is affording.

* * * * *

■ 110. RULES FOR CARE AND USE.

* * * * *

d. Disposition while traveling. (Added.)—Gas masks should be carried on person, not packed in baggage, while traveling. Packing of gas masks in barracks bags may result in broken eyepieces, crushed canisters, and torn carriers.

e. Protection against extreme cold. (Added.) In extreme cold, gas mask facepieces become stiff. This stiffness disappears when the facepiece is placed in a warm room or when facepiece is carried under the clothing when wearer is out of doors. The facepiece may also be softened by kneading it with the hands. A more satisfactory method, where practicable, is to store the mask in a warm room, before issue.

■ 111. STORAGE IN ORGANIZATIONS.—*a.* The following rules * * * storage of masks:

(1) Store in a dry place, avoiding extremes of temperature.

* * * * *

■ 114. USE.—Protective clothing (par. 35*a*) * * * likely be encountered. In the second situation, permeable protective (impregnated) clothing (two layers) provides good protection for all cases where blister gas vapor or spray is encountered.

* * * * *

b. Permeable clothing.—The permeable type * * * and small drops. Increasing the amount of impregnite above the minimum does not correspondingly increase protection against larger drops. The ordinary field * * * also be worn.

■ 127. DETECTION DEVICES.

* * * * *

b. Paper, liquid vesicant detector, M6.—This item consists * * * gas detector paint. Either DANC, M4 ointment, or M5 ointment, applied to detector paper, causes an immediate color change similar to that produced by liquid vesicants. The paper may be used to detect liquid vesicants in—

* * * * *

■ 132. FOR MUSTARD GAS.

* * * * *

b. Chlorinated lime (bleaching powder).—(1) This material is * * * for chlorinated lime.

(2) (Superseded.) An alternative method of using chlorinated lime is to mix it with water to form slurry. This is a 50–50 mixture by weight of bleaching powder and water. Slurry is spread over the surface to be decontaminated and left for 24 hours if possible. The 50–50 slurry mixture is the most effective mixture for use with brooms or swabs. If mixed by volume rather than by weight, 6 shovelfuls of bleach are used with one 14-quart bucketful of water. Complete coverage is necessary and should be followed by scrubbing to dislodge blister gas and fill cracks with slurry. Slurry should remain in contact with the contaminated surface for from 6 to 24 hours, after which it is removed by washing down, scrubbing, and rinsing with water.

(3) (Superseded.) (As added by C 1.) Another method of using chlorinated lime is in the 400-gallon power-driven decontaminating apparatus. (See par. 138.)

* * * * *

d. Miscellaneous chemicals.

* * * * *

(3) *Neutralizing agents.*—Alkalies such as * * * action of water. A solution of 3 pounds of soap shavings or soap powder and 3 pounds of washing soda per 100 gallons of water provides a good detergent for spraying. Semisolid and liquid commercial detergents are also suitable.

■ 138. Power-Driven Decontaminating Apparatus.—*a. General.*

* * * * *

b. Charging. (Superseded.) (1) *Mixture.* Forty parts by weight of bleach and 60 parts by weight of water are agitated in tank for from 4 to 20 minutes, depending upon the charge. An apparatus accommodates a mixture of 1,300 pounds of bleach and 224 gallons of water, and requires up to 45 minutes to load and mix. Personnel should wear masks when emptying containers of bleach.

(2) *Antiset agent.* If available, add antiset (sugar) in the proportion of ½ pound of antiset per 100 pounds of bleach. Antiset must be added to the water before the bleach is added. Antiset agent helps prevent clogging of bleach in the apparatus.

* * * * *

■ 139. Bathing Units. (Superseded.) Men who have been contaminated with chemical agents should bathe with warm

water as prescribed in paragraph 116*b*. The M3A2 400-gallon power-driven decontaminating apparatus and M1 portable water heater, which is auxiliary equipment issued with the 400-gallon apparatus, provide field bathing facilities. (See TM 3–223 and TM 3–228.)

■ 147. MATERIALS.

* * * * *

c. Rubber and leather.—Rubber and leather * * * in warm water. **Heavily contaminated rubber may be decontaminated by submerging it completely for a sufficient time in plain water maintained just below the boiling pont. Two hours suffice for gloves, 3 hours for other items. If contamination is light or caused by vapor, the materials may be aired in the sun or wind for several days. DANC should not be used to decontaminate rubber, except rugged items such as gloves. Leather may be decontaminated satisfactorily if immersed in water of from 122° to 131° Fahrenheit for 4 to 6 hours, allowed to dry in air (no excess heat applied), and subsequently treated with shoe impregnite M1. DANC is suitable for use on leather. (See TM 3–220.)**

■ 177.1. COMBAT EFFICIENCY. (Added.) Emphasis should be given to wearing the gas mask in training exercises. It prevents serious reduction in combat efficiency of troops who may have to wear the mask for long periods during a gas attack. Wearing the mask should not be confined to gas mask drill. Suggested activities during which troops could wear the mask at least part of the time include: day and night marches; field and firing exercises; at double time for short distances; performing regular duties; and participation in athletic events such as baseball, softball, and volley ball. **A definite amount of time each week devoted to such training insures combat efficiency of troops during a gas attack.**

■ 187. CHARTS. (Superseded.) Colored charts supported by a steel frame have been prepared by the Chemical Warfare Service. Five drawings in the set, considered suitable for continued use in training, are—

Gas mask canister.
Typical arrangement for gasproofing dugouts.
4.2-inch chemical mortar shell.
4.2-inch chemical mortar.
HC smoke pot.

Other drawings of the set are obsolete and should not be used in training.

[AG 300.7 (5 Mar 45)]

BY ORDER OF THE SECRETARY OF WAR:

OFFICIAL:

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Major General
The Adjutant General

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